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THE PROBLEM OF MARINE BIOLOGY.

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In common with the other branches of biological science, the study of marine life has made wonderful advances in the past half century, and we now begin to get a proper conception of the vastness and importance of this realm of nature.

The study of marine life has been compassed by serious difficulties; on shipboard it is impossible to examine in the living condition the enormous quantity and endless variety of forms brought up at a single haul of the net or dredge; and the old method of merely dropping the specimens into vials of alcohol resulted in vials of wrath to the naturalist who later studied the creatures in hopes of gaining from the distorted relics some knowledge of the normal appearance and anatomy. Now all this is changed, and by aid of certain chemical reagents most animals can be killed and preserved in a manner very satisfactory for study of their gross and microscopical anatomy, and hence the material collected can be examined at leisure in permanent laboratories with results corresponding to the better facilities. There has, too, been a great lack of suitable and accurate collecting apparatus. The early method was to scoop up a quantity of sea water and then tediously examine it in small quantities under the microscope. In 1845 Johannes Müller, the great pioneer of marine biology, conceived the idea of condensing into a small volume of water

the forms which would be found in a very great area. This resulted in the invention of the "Müller Net," a small gauze net which is drawn through the water, entangling in its meshes the very minute and delicate organisms. For a long time Müller and his students pursued the study of marine forms, and at length came the discovery that the marine fauna and flora was directly comparable to the terrestrial.

Yet little is known of the laws of the distribution of marine life. The laws of the distribution of the terrestrial fauna and flora have been formulated for animals in the classical works of Wallace and for plants by Griesbach. The famous "Challenger" expedition (1873–1876), under the direction of Sir Wyville Thompson and Dr. John Murray has given us the largest conception of the wealth of marine life, and has laid the foundations for the study of the marine forms both at the surface and in the depths of the ocean. Dr. Murray in his preliminary report called particular attention to the enormous wealth of organic life not only at the surface, but also many hundred fathoms below. He says that when living forms were scarce on the surface the tow net usually disclosed very numerous forms below, even to a depth of 1000 fathoms or more. In the North Pacific Ocean the discovery was made that zones of definite depth are characterized by animals and plants peculiar to them. The tow nets sunk to 500, 1000 or 2000 fathoms brought up forms never found within 100 fathoms of the surface. The animals characteristic of these different depths are, for the most part, of the class of Radiolorians, those microscopic organisms whose silicous skeletons form much of the soft ooze which carpets the bottom of the deep sea. Prof. Haeckel, by study of this material was led, in his monumental work on the Radiolaria, which forms a part of the "Report of the Challenger," to the recognition of three groups, (*a*) pelagic, swimming at the surface of the calm sea; (*b*) zonary, swimming in definite zones of depth (to a depth of more than 20,000 feet); (*c*) profound (or abyssal) animals swimming immediately over the bottom of the deep sea. In general the different characteristic forms correspond to the different zones (up to 27,000 feet).

The existence of this intermediate pelagic fauna was called in question by Alexander Agassiz, on the ground of the liability of error in using the ordinary open net instead of one which could be closed at a definite depth and then drawn up; and more particularly upon the ground of his own experiments made in 1878 on the "Blake" expedition. He believes that the great bulk of the ocean contains no organic life at all, that the surface fauna of the sea is limited to a relatively thin layer, and that there is no intermediate layer, so to speak, of animal life between the fauna of the bottom of the deep sea and of the surface.

Agassiz's results are contradicted by those of Chierchia on the Italian corvette "Vettor Pisani." With the closable net invented by Palumko he brought up an astonishing quantity and variety of forms of life from different depths, even up to 4000 meters. Prof. Carl Chun, with an improved closable net, studied the marine fauna and flora of the Gulf of Naples. He formulates his results as follows: 1. That part of the Mediterranean investigated shows a rich pelagic life even to a depth of 1400 meters, as well as at the surface. 2. Pelagic animals, which during the winter and spring appear at the surface, at the beginning of summer seek the depths. 3. At greater depths pelagic animals occur, which hitherto have seldom or not at all been observed at the surface. 4. A number of pelagic animals during the summer remain at the surface and never go into the depths. From his observations upon the vertical distribution of marine life he was led to remark that the surface fauna was apparently only the advance guard of the vast army below. His conclusions were confirmed by observations made during a trip to the Canary Islands, and agree with those made by Prof. Haeckel twenty years before.

Prof. Hensen, of Kiel, has for several years past been studying the phenomena of pelagic life with a view of ascertaining its relations to the fisheries question. He has proposed the term Plankton (from πλάνομαι, to wander) to designate this world of marine life. Prof. Haeckel agrees with this and adds Planktology, that branch of biology which deals with the study of the Plankton. Prof. Hensen hopes to gain val-

uable information upon the phenomena of marine life by a careful mathematical estimation of the number of individuals in a given bulk of water. Presumably from this and other data some knowledge may be gained of the quantity of life which any definite area of the sea is capable of sustaining.

Prof. Ernst Haeckel, of Jena, has lately published an admirable resumé of our knowledge of pelagic life, and has made a very distinct advance by formulating some of the laws which govern its distribution. He has probably done more than any one man to advance our knowledge on this line. Ever since 1854, when, as he tells us, he accompanied the great Johannes Müller to Heligoland and was there introduced by his master to the marine wonderland, he has almost continuously pursued the study of the Plankton. He believes that aquatic life in its broadest features shows conditions of distribution similar to those of terrestrial life, and that we may for the former as well as for the latter distinguish five great geographical provinces, each represented by characteristic forms of animals and plants. 1. The Arctic Ocean. 2. The Atlantic. 3. The Indian. 4. The Pacific. 5. The Antarctic.

All aquatic organic forms fall into two great divisions. 1. Those which live free in the water, either swimming actively or passively floating at the mercy of currents and winds. These compose the Plankton. The Plankton thus includes the widest range of organic size and form, from the minutest microscopic organisms to the gigantic cetaceans. 2. Those forms which live upon the sea bottom, either fixed or creeping about. To these the term Benthos (*τό βένθος*, the bottom of the ocean) is applied. The variety of forms living near the shore is known to vary with the depth, while the forms characteristic of the comparatively shallow waters of the coasts are widely different from those which inhabit the bottom of the deep sea.

The number and the kind of forms composing the Plankton are found to differ with the quality of the water, *i. e.* fresh or salt. In the ocean there is a marked difference which is conditioned by the distance from the shores, either of continents or islands. There are many species of animals, particu-

larly certain coelenterates, echinoderms and worms, which pass only part of their life as free swimming animals; for the remainder they are bottom dwellers. Such species are not usually found far from the coast, and hence the true oceanic Plankton is made up of forms which pass their entire life as free swimming organisms. By the presence or absence of these bottom dwelling species the Planktologist can determine approximately the region where the forms were captured.

A mere list of the genera, not to mention the species of plants and animals up to the present found to take part in the constitution of the Plankton would be very formidable. The range in size is enormous; from the exceedingly minute unicellular algae $\frac{1}{25000}$ of an inch in diameter to the huge bulk of many fishes and cetaceans. The microscopic forms constitute the fundamental food supply in the cycle of marine life. They are capable of exceedingly rapid multiplication, and furnish nourishment for the myriads of large animals, which in time are preyed upon by the still higher forms. The inconceivable number of individuals of the smaller species is demonstrated by Prof. Hensen's determination of the number of individuals in about two cubic yards of Baltic Sea water. This was found to contain 5,700,000 distinct organisms; of these only about 150,000 were visible to the unaided eye. But very often microscopic forms become so numerous as to form a slime upon the surface of the water for a considerable area. Ships frequently sail for miles through water colored by these microscopic organisms, *e. g.* the so-called "black water" of the Arctic and Antarctic Seas, is a slime of diatoms, which serve as food for the shoals of minute crustacea and mollusca (Pteropods, sea butterflies, and Cephalopods, squid, cuttlefish) upon which the walrus and whales feed. In the warm regions the inconceivably enormous quantity of diatoms are replaced by another kind of algæ, the Oscillatoriæ, which often for an area many miles in extent color the sea a dark red or yellowish brown. The Red Sea received its name from the abundance of one of these algæ, *Trichodesmium erythræum*, which, according to Ehrenberg, colored the water along the shore a blood red. In the warm region also are

found the huge floating banks of Sargassum, or gulfweed, forming the so-called Sargasso Seas of the Atlantic and Pacific Oceans. These areas are found to have a marine fauna and flora peculiar to themselves, but approximating in character to that of the coast waters.

The simplest forms of animal life of the Plankton belong to the groups of Infusoria and Rhizopods; to the latter belong those minute animals, the Foraminifera and Radiolarians, which occur in such enormous quantities that their calcareous and siliceous shells form the "deep sea ooze" which carpets the bottom of the deep sea. It is the shells of these animals too, which have built the vast chalk beds in various parts of the world. Among the multicellular animals which take a prominent part in this marine world are many species of medusæ (jelly fish) and the closely related Siphonophores, of which the beautiful Portuguese man-o'-war is the most familiar representative. The class of worms is represented by many free-swimming species; but in the number of individuals it is far surpassed by the molluscs, chiefly represented by the squids, the pearly and paper nautilus, and the huge cuttlefish, and by the minute and delicately beautiful sea butterflies (Pteropods), which occur in vast schools in the polar seas. Often too, in very considerable number are found the free-swimming larvæ of Echinoderms, as also many worm larvæ, which, like the former, pass their adult life upon the bottom. Every haul of the gauze net is certain to contain some representatives of the great class of Crustacea, often great numbers of species, as well as of individuals. In distribution these seem to be subject to pretty definite laws, and a careful study of the phenomena would be of great interest. There are found also certain Tunicates, a group interesting because many investigators believe that here we find the transition from the invertebrate ancestor to the higher plane of life of which man is at present the highest representative.

The vertebrates of the Plankton embrace the great group of fishes, and in addition the marine birds, the seals and walrus, and finally the cetaceans. In this connection, too, the enormous number of fish eggs floating at the surface of the ocean,

as well as the transparent, newly-hatched fry must be mentioned. Prof. Hensen hopes to get an idea of the approximate number of fish of a given species in a certain area, computing the number of eggs and fry of that species within that area.

The phenomenon of marine phosphorescence is very widely known with admiration and wonder. Its cause is chiefly or solely bound up with organic life. The majority of pelagic animals display the phosphorescent light in different degrees. In some the entire living animal is brighly luminous; in other the light is limited to special organs. But much of the phosphorescence of the ocean appears to be caused by the fragments of dead organisms, and is connected with the presence of bacteria.

Since many chlorophyll-bearing organisms are found at depths unpenetrated by sunlight it has been suggested that the light necessary for their growth is furnished by the phosphorescent organisms.

The composition of the Plankton is exceedingly irregular, both in qualitative and in quantitative relations; its distribution in the ocean is also very irregular, both in time and in place. The variations occur near the shore as well as far out at sea. Very often the greater part of the mass of Plankton is made up of organisms belonging to a single group. Sometimes unicellular algæ make up nearly the whole bulk, at another medusæ, siphonophores or ctenophores; indeed, almost any group of marine organisms may occur in such quantities as to compose more than one-half of the total bulk of the Plankton, at that time and place. The fundamental causes of variation in the quantity and quality of the Plankton appears to be conditioned by time, climate and currents.

Temporal Differences.—For a satisfactory determination of these more complete observations are needed. Reliable data can be furnished by the observations at the numerous marine laboratories and zoological stations now springing up in different parts of the world. The causes which underlie these yearly, monthly, daily and hourly variations are manifold; in part meteorological, in part biological. They are comparable

to the corresponding oscillations of the terrestrial fauna and flora, and depend on the one side upon climatic and meteorological conditions, and on the other upon the varying mode of life, particularly upon conditions of reproduction and development. Just as the annual development of most land plants is bound up with a definite time of year, as the time of budding and leafing, of blooming and fruiting, have in the "struggle for existence" become adapted to the meteorological conditions, the time of year and other conditions of existence, so too the annual development of most marine animals is conditioned by definite habits, which have become fixed by heredity. The yearly variations may be compared to the good and bad fruit years. This yearly variation has been noted by many observers in case of many marine animals. Our attention is often called to an example of it in the unusual abundance or scarcity of the catch of certain food fishes.

Many marine animals, particularly certain medusæ, siphonophores, ctenophores, molluscs and tunicates, are found at the surface only periodically, in one or a few months of the year. This is probably dependent upon conditions of reproduction and development, as well as upon the temperature of the season. The daily variations are conditioned by the weather and particularly by the wind and rain. A shower will very quickly reduce the specific gravity of the surface water and thus drive the surface dwelling animals below. Many animals rise to the surface only at a definite time of day, some in the morning, others at noon, and yet others only towards evening.

Climatic Difference.—Prof. Haeckel thinks that the quantity of the Plankton is very little dependent upon the climatic difference of the zones, but that the quality is greatly so, and indeed in this way, that the number of component species diminishes from the equator to the poles. These conditions, he believes, are directly referable to the influence of the sun, "the omnipotent creator," whose more direct rays bring about an acceleration in the processes which make up the cycle of life. As this is true of the terrestrial fauna and flora so it is true of the marine.

Currentic Differences. — Conspicuous differences are also brought about by the numberless currents, great and small, by the little-known deep sea oceanic currents as well as by the better-known great surface currents, the Gulf stream, the Falkland stream, the Guinea stream and others. These currents play a great rôle in the distribution of many forms of life. More local influences are exerted by the small currents whose causes are found in the climatic and geographical conditions of the adjacent coast. The relations of Plankton life to currents is little known, and needs investigation, but first a better knowledge of the currents themselves is necessary.

Almost everyone who has seen the surface of the ocean in a calm has noticed the glassy areas of irregular shape. These are found on the high seas as well as in sheltered bays and harbors, and are of very special interest to the student of marine life. So far as made out they are extremely irregular in time and place of appearance, and the conditions governing them have not been carefully studied. They are in a measure influenced by winds and currents, by the ebb and flow of the tide. Here, into a limited space, are crowded great numbers of organic forms; this space is readily distinguished from the surrounding water in which there is comparatively little life. These phenomena have been noticed by seafaring men and have many different names in different countries.

A word in conclusion as to the bearing and importance of the Plankton in human economy in the near future. When Malthus promulgated his famous doctrine he failed to consider the final element which enters into the problem of human population, the human mind. The ingenuity of the human mind has brought about a decreased efficiency in the natural checks to undue increase, and thus an artificial increase in the food supply is rendered necessary for the crowding population. This food supply is now mainly derived from the cultivation of the land. A still further increase of population will necessitate a levy upon marine life. As soon as man to any great degree becomes a factor in the Plankton conditions by drawing from it large quantities of food, particularly in the form of mature animals, the equilibrium of oceanic life

will be disturbed, and must be adjusted by artificial means. But further, a study of the phenomena of marine life shows that the water as well as the land, through cultivation, is capable of producing a greatly increased food supply for man. The necessity of cultivating the marine resources is even now apparent, and many governments have already begun to cope with the question by the establishment of commissions of fisheries. Of these commissions that of the United States stands in the front rank by virtue of its positive results. But in the near future individual attention must be turned to supplementing the terrestrial resources, the wheat fields, the cattle and sheep ranches, by an increasing utilization and development of the possibilities of marine farming; by fish propagation, by plantations of oysters, clams, quahaugs and scallops, by raising herds of lobsters and crabs. Improved breed of fish, of lobsters will result. The possibilities are well-nigh limitless; and by cultivation of the sea and sea bottom as well as of the land, man will postpone indefinitely the fulfillment of the Malthusian prophecy.

But conditioning all advance in the possibilities of marine cultivation is the knowledge of the Plankton, of its distribution, and of the fundamental basis of marine life, the microscopic marine organisms in the ocean.

IMPORTANCE OF THE SCIENCE AND OF THE DEPARTMENT OF PREHISTORIC ANTHROPOLOGY.

By THOMAS WILSON.

(*Continued from page 689.*)

The International Congress of Anthropology and Prehistoric Archeology held its Eleventh session in Moscow during August, 1892. This Congress was organized and has been holding its regular sessions since 1865 or '67. It has had delegates from all neighboring countries; they have usually met in the capital of the country, and never twice consecutively in the same country, with a number of members varying from 500 to 1500, according to the contiguity of the place of meeting. Their bulletins have formed volumes of several hundred pages (that at Stockholm over a thousand), yet no scientific organization from the United States has ever had any representative, and since the meeting in Paris in 1878 there have not been three citizen representatives of the United States at any one of the meetings. The same comparison continued with regard to the means of instruction in the different countries, America and Europe would make about the same showing. Each of the countries of Europe may, I think, fairly claim that they are equal to, if not ahead of, the United States in their appreciation of and assistance to the science of Prehistoric Anthropology; even little Switzerland, with a territory of 16,000 square miles, would say she was not behind us. France, with her area of 204,000 square miles, would undoubtedly claim superiority over the United States. The area of the United States is greater by far than that of all Europe, and its archæologic field, acre for acre, is equally rich in specimens, and would afford a proportionate number and a proportionately good opportunity for the study of the history of the prehistoric man, and yet I repeat, every country in Europe, if it but knew the exact status in the United States,

would claim that it was superior in interest and study of the science of Prehistoric Anthropology.

In the means of education in this new science the same comparison holds good between Europe and the United States. In the societies of the different countries, established for the advancement of science, a section is devoted to anthropology, as is done in the United States. But the ten different countries of Europe make ten different societies there against one in America. In France, Germany, Italy, Denmark, Sweden, Scotland, and possibly in England, though I cannot say certainly, there have been courses of lectures organized and conducted in connection with the societies of anthropology and the museums (such as comprise my department), in nearly all the principal cities. I may mention that of Paris as the most extensive and complete, yet the others are of no mean proportion. In Paris the organization comprises eleven lecturers, each one lecturing once each week (eleven lectures per week), during the entire college season from October until June, all being upon the subject of Anthropology. The lecturers are paid for their services and they carry on their work continuously and with an earnest diligence for which we can find few parallels in the United States. The good effects of these lectures and of this education is manifested in the interest taken in the society which numbers at Paris nearly 700 members, with an annual income of 20,000 or more francs, and with a capital reserve of over 50,000 francs.

The following is the program of weekly lectures for the present year 1891–92.

Prehistoric Anthropology, M. Gabriel de Mortillet; Somatology, Mathias Duval; Geographic Anthropology, M. Fr. Schrader; Ethnography and Language, M. André Lefevre; Ethnology, M. Georges Hervé; Biologic Anthropology, M. J. V. Laborde; Zoologic Anthropology, M. Mahoudean; Medical Geography, M. Dr. A. Bordier; Physiological Anthropology, Dr. Manouvrier; History of Civilization, Dr. Letourneau; Comparative Ethnology, M. Adr. de Mortillet.

Any mention of similar efforts or labors in the United States would surely omit some institutions or persons despite

the best intentions and the greatest care, or might under- or over-rate those noticed.

Readers within the United States will be acquainted with these efforts, and it would serve no purpose to tell them what they already know. To avoid possible complications arising from unintentional omissions or misunderstood comparisons no statement of this work in the United States is attempted.

Enlarging upon this question of the comparative want of interest on the part of the United States Government and people, I might remark the number of missions which have been sent out by these European governments in pursuit of this science. In 1884–'85 France sent Dr. Poussie to Australia and India to make studies in ethnography, Le Bon to India to study primitive architecture, Jules Monsier to make archæological researches in Caucausus, De Morgan to Armenia, Monsieur Brau to Malacca and Sumatra to make ethnographic collections, Gauthier to Turkey and Persia for researches in natural history and anthropology. Ernest Chantre, Curator of the Prehistoric Museum at Lyon, was sent by the Government to make anthropological researches in the Caucausus. He has published his report in five large volumes, quarto, with 446 figures and 140 chromo-lithographic or heliographic full page plates. M. Cartailhac was sent on a like mission to Spain and Portugal. His report is published in a large volume with 450 engravings and four plates. The most extensive and complete works, with the finest illustrations concerning our own country do sometimes come from the hands of these foreigners thus sent out. Weiner reports Peru, Lucien Briart the Aztecs, while the most comprehensive work on the subject entitled "Prehistoric America," is written by a Frenchman, Marquis Nadaillac.

The Curators of European museums are being continually sent to visit and examine other prehistoric museums than their own. In a report published by the keeper of the National Museum of Antiquities at Edinburgh, Dr. Anderson and his assistant, Mr. Black, is to be found a note of some of these visits. In connection with most of the principal archæological museums on the continent, provision has been made

for enabling the officers and attaches of the museum to enlarge their knowledge in the lines of their specialties by travel and research. In 1842–'45 Worsaae was sent from Copenhagen through Sweden, Norway, North Germany and Russia; in 1846–'47 to Great Britain, and the result was the publication of his "Danes and Northmen in Britain," which is still the standard work. Mr. Undset, an attache of the Christiana Museum, was sent to Sweden, Denmark, Germany, France and Britain, as a result of which he published his "Norse Antiquities." Since then he has traveled over Europe and published his report, "The Iron Age in Europe," the standard book on that subject. In 1878–'79 Dr. Sophus Muller, an attache of the Prehistoric Museum at Copenhagen, was sent through Germany, Austria and Italy, returning through France and Britain. He studied the Zoomorphic Ornament in Europe and has published a complete monograph on the subject. Dr. Montelius, of the National Museum at Stockholm, was sent throughout Europe to study the "Fibulæ of the Bronze and Iron Ages." Sweden and Norway each set aside $560 annually for similar purposes. The report of Dr. Anderson which I have just mentioned, was the result of sundry voyages made throughout Scotland, visiting the local archæological museums for the expenses of which an annual appropriation of $200 has been made.

The closer we examine and study the policy of the European governments and compare their achievements and those of their people and institutions with those of Government and kindred institutions in the United States, the greater the contrast. Take the laws of the various European governments for the preservation of by obtaining title to mounds, earthworks, caves, dolmens, and other prehistoric monuments. The most of the European countries have passed such laws. In England Stonehenge is under the care of the government, and Abury is in the same line if the transfer has not been actually completed. Denmark, Sweden and Norway own great numbers of prehistoric monuments. In France they are to be counted by the hundreds, while Italy probably surpasses all others. In Italy these matters have received most serious

consideration at the hands of the Government, and a complete system of laws are now in force providing for the proper investigation of these monuments, their preservation and the conservation of the objects found therein. Any person in the Kingdom making a discovery of archæological objects is required to make it known to the proper department of the Government at Rome. If he would excavate he must also notify the Government, and it will send an inspector who will supervise the excavation, keep a diary of all work done and a register of all objects found. This he does from actual observation, for he is required to be on the ground every day during the progress of the work.

At Corneto-Tarquini the excavations have been continued for twelve years, practically by the same band of workmen under pay of the town with a permanent Government inspector. All objects found are registered and reported to the Government. Nothing will show the contrast between the interest in these matters shown by the Government of Italy and that of the United States better than to tell the purpose of this register. It is that the Government may have control over the objects; that if they be desired by the Government for any of its museums it may have the prior right to purchase at a fair valuation, and if the objects be sufficiently rare and valuable from an artistic or scientific point of view it may prohibit and prevent their exportation and consequent loss to the country.

The United States, so far from having any such governmental control over or interest in any of the prehistoric antiquities, whether monuments or otherwise, has had no serious thought of such control. Neither the Government nor any of its officers or institutions have ever, to my knowledge, even considered a proposition for the purchase of any of these prehistoric monuments, and if they or any of them have ever supervised or inspected an excavation it certainly has not been with a view to purchase the objects that they might be displayed in any of the museums. No officer or institution of the United States has either power or authority to purchase real estate, whether it be a prehistoric monument or not.

No such power has ever been given by Congress, and our position to-day upon this subject is such that the Smithsonian Institution, which may fairly claim to be the representative scientific institution of the Government, cannot purchase any of our numerous prehistoric monuments for the preservation (as was done in the case of the Serpent Mound in Ohio) for want of the necessary legal authority. More than that, it cannot accept and hold the title to any such monument, however great its value or necessity of its preservation, even if presented as a gift.

In all the investigations and publications made by or in the United States concerning prehistoric man, the almost sole object of their investigation and report has been the American Indian. It was Indian first, last, and all the time. The Indian which they investigated was as modern and historic as he was ancient and prehistoric, and in the investigations the former view was kept more prominent than the latter; indeed the latter has been almost entirely overlooked. Even much of the investigation among the mounds has been to prove their modern construction, their relation to the modern Indian, and to show that if not entirely made since the discovery of the continent by Columbus, they have continued from such a short time previous as to be practically of that epoch.

These comments are not made in a spirit of complaint or reproach, but to confirm the statement that our Government and people have not taken the interest in prehistoric researches that has been exhibited by those of Europe. And the comparison has been forced upon the attention of the writer from a personal observation made during several years in European countries.

The duty of investigating prehistoric man of the United States clearly belongs to the scientists of our country. It is the history of our own people and country depending upon the investigations to be made upon our own soil; a studying, and if need be the excavation of monuments erected upon our own territory. If it is to be done at all it should be done by us. True, there is no legal obligation requiring us to make these investigations or perform this labor, and naught but

national pride and our own self-respect will compel it. We should here apply to science, the Monroe Doctrine of politics. We should recognize and declare our own ability to do this work, and our intention to perform it—that we may contribute to the science of the world a history of our prehistoric people. If the work is not to be done by us or if it be insufficiently performed it should not be because the matter was neglected or forgotten by either our government or people, but for the reason we decided it was not worth the effort, and in this way we must justify ourselves in the eyes of the world.

The sciences of Mathematics, Philosophy, Astronomy, Chemistry, Metallurgy, Classic Literature and Archæology, those general and not local, have recognition, but their claims rest upon other countries with equal weight as upon ours. Our country is under no greater obligation in respect of these and similar sciences than are other countries of the world. But in respect of the Prehistoric Anthropology of this country it is different. The duty rests solely upon us. The Smithsonian Institution and National Museum stand as beacon-lights to the American people, and are the representative scientific institutions of our country. In this regard they stand for the United States Government and speak for it. They have the ear of its Executive and of its Legislatures, and exercise an influence with the Government not possessed by private individuals or organizations; and, therefore, a certain responsibility rests upon them whether they will or not.

As a means of correcting the defect mentioned I would respectfully suggest the giving of greater attention to the dissemination of information among the people. This can be done through publications, by means of lectures and by the organization of kindred societies for concert of action and more expensive preparation at their meetings for the presentation of this subject in its proper light. I would also suggest the preparation of specimens illustrating the science of Prehistoric Anthropology, accompanied with descriptive letter press and catalogues,[1] these to be distributed to all institutions

[1] I have prepared during the past year, under the direction of the Smithsonian Institution, 100 sets of typical prehistoric implements for exchange.

of learning in the United States, receiving in exchange such implements and objects as are possible. Perhaps the most important factor of all would be the endeavor to increase the knowledge and interest of the executive and legislative officers of our Government so that the science of Prehistoric Anthropology would receive in the future their countenance and support.

Applying this argument, I suggest that if any department in the National Museum is to be extended or enlarged, is to have greater opportunities for research, more help employed, more money expended, either in publications, illustrations, investigations or in the purchase and display of rare or fine specimens it should be that of Prehistoric Anthropology rather than any other.

THE COMPARATIVE PHYSIOLOGY OF RESPIRATION.[1]

By Simon H. Gage.

Among the very first of the physiological acts observed were those of respiration. The regular movements of breathing, from the first feeble efforts of the new-born babe until the sigh in the last breath of the dying—after which is silence, cold and dissolution—have commanded the attention and claimed the interest of every-one, the thoughtful and the thoughtless alike. And one comes to feel that in some mysterious way "the breath is the life." But in what way does breathing subserve life or render it possible? Aristotle and the naturalists of the olden time supposed that it was to cool the blood that the air was taken into the lungs, and, as they supposed, also into the arteries. With the limited knowledge of anatomy in those early days and the fact that after death the arteries are wholly or almost wholly devoid of blood, while the veins are filled with it, what could be more natural than to suppose that the arteries were vessels for the cooling air. If one supposes that he has entirely outgrown this view of Aristotle let him think for a moment how he would express the fact that an individual is descended from the Puritans, for example. In expressing it even the physiologist could hardly bring himself to say other than "he has the blood of the Puritans in his veins." Would he ever say "he has the blood of the Puritans in his arteries?"

As observation increased the cold blooded animals were more carefully studied and found to possess also a respiration; they certainly do not need it to cool the blood. Then there are the insects and the other myriads of living forms that teem in the oceans, lakes, rivers and even in the wayside pools. Do these too, have a breath? And the plants on the land and

[1]Address by Prof. Simon Henry Gage, of Cornell University, Ithaca, N. Y., Vice-President of the Biological Section of the American Association for the Advancement of Science, Rochester, August 17, 1892.

in the water, is the air vital to them? Aristotle and the older naturalists could not answer these questions. To them, on the respiratory side at least, all life was not in any sense the same.

It was not until chemistry and physics were considerably developed, not until the air-pump, the balance and the burette were perfected that it was possible to give more than a tentative answer. Not until the microscope could increase the range of the eye into the fields of the infinitely little, was it possible to form even an approximately correct conception. The first glimmerings of the real significance of respiration for all living things was in the observation that the air which would not support a flame, could not support life, although it might be breathed. That is, there must be something in the transparent air that feeds the flame and becomes the breath of life, the real *pabulum vitæ*, the merely mechanical action of the air not being sufficient.

Since the experiments on insects and other animals with the air-pump by Boyle (1670), by Bernuilli on subjecting fishes to water out of which all the air had been boiled, and those of Mayow (1674), it became more and more evident that respiration was not confined to the higher forms but was a universal fact in the organic world. Then came the most fruitful discoveries of all, made by the immortal Priestley (1775–6), viz., that the air is not an element but composed of two constituents, nitrogen, which is inert in respiration, and oxygen, which is the real vital substance of the air, the substance which supports the flame of the burning candle and the life of the animal as well.

What would seem more simple at this stage of knowledge than that the parallel between the burning candle and the living organism should be thought to represent truly the real conditions? That as the candle consumes the oxygen in burning and gives out carbon dioxide, so the living thing breathes in oxygen and gives out in place of that consumed, carbon dioxide. And as in each case heat is produced, what would be more natural than to look upon respiration as a simple combustion? This was the generalization of Lavoisier (1780–89). As he saw it, the oxygen entered the lungs, reached the blood

and burned the carbonaceous waste there found and was immediately given out in connection with the carbon with which it had united; and as the gas given off in a burning candle makes clear lime water turbid, so the breath produces a like turbidity.

But here, as in many of the processes of nature, the end products or acts were alone apparent, and while the fundamental idea is probably true that respiration is, in its essential process, a kind of combustion or oxidation, yet the seat of this action is not the lungs or blood. If the myriads of microscopic forms are considered, these have no lungs, no blood, and many of them even no organs; they are, as has been well said, organless organisms, and yet every investigation since the time of Vinci and von Helmont, Boyle and Mayow, has rendered it more and more certain that every living thing must in some way be supplied with the vital air or oxygen, and that this is in some way deteriorated by use. The nearer investigation approaches to the real life stuff or protoplasm, it alone is found to be the true breather, the true respirer. And further, as was shown long ago by Spallanzani (1803–1807), if one of the higher animals, as a frog, is decapitated and some of its muscle or other tissue exposed in a moist place it will continue to take up oxygen and give out carbon dioxide, thus apparently showing that the tissues of the highly organized frog may, under favorable conditions, absorb oxygen directly from the surrounding medium, and return to it directly the waste carbon dioxide. This proves conclusively that it is the living substance that breathes, and the elaborate machinery of lungs, heart and blood-vessels is only to make sure that the living matter, far removed from the external air shall not be suffocated. Still more strange, it has been found that if some of the living tissue is placed in an atmosphere of hydrogen or nitrogen entirely devoid of oxygen, it will perform its vital functions for a while, and although no oxygen can be obtained it will give off carbon dioxide as in the ordinary air. If it is asked how can these things be? the answer is apparently plain and direct. Not as the oxygen unites directly with the carbon in the burning

candle does it act in the living substance. The oxidations are not direct in living matter as in the candle, but the living matter first takes the oxygen and makes it an integral part of itself, as it does the carbon and nitrogen and other elements; and finally when energy is to be liberated, the oxidation occurs, and the carbon dioxide appears as a waste product.

The oxygen that is breathed to-day, like the carbon or the nitrogen that is eaten, may be stored away and represent only so much potential energy to be used at some future time in mental or physical action.

So far only living animal substance has been discussed. If plants are considered what can be said of their relations to the air? The answer was given in part by Priestley (1771), who found that air which had been vitiated by animal respiration became pure and respirable again by the action of green plants. He thus discovered the harmonizing and mutual action of animals and plants upon the atmosphere; and there is no more beautiful harmony in nature. Animals use the oxygen of the air and give to it carbon dioxide, which soon renders it unfit for respiration; but the green plants take the carbon dioxide, retain the carbon as food, and return the oxygen to the air as a waste product. This is as thoroughly established as any fact in plant physiology, and yet in his work Priestley had some which he called "bad experiments," for instead of the plants giving out oxygen and purifying the air they sometimes gave off carbon dioxide, and thus rendered it more impure, after the manner of an animal. What investigator cannot sympathize with Priestley when he calls these "bad experiments?" They appeared so rudely to put discord into his discovered harmony of nature. But nature is infinitely greater than man dreams. The "bad experiments" were among the most fruitful in the history of scientific discovery. Ingenhausz (1787) followed them up, carefully observing all the conditions, and found that it was only in daylight that green plants gave out oxygen; in darkness or insufficient light they conducted themselves like animals, taking up oxygen and giving out carbon dioxide.

Finally it was proved by Saussure (1804) and others that for green plants, and those without green, like the mushrooms, oxygen is as necessary for life as for animals. It thus became evident that this use of oxygen and excretion of carbon dioxide was a property of living matter, and that the very energy that set free the oxygen of the carbon dioxide was derived from oxidations in the green plant comparable with those giving rise to energy in animals. Further, that the purification of the air by green plants in light is a separate function—a *chlorophyll function*, as it has been happily termed by Bernard—and resembles somewhat digestion in animals, the oxygen being discarded as a waste product. Indeed, so powerful is the effort made to obtain oxygen for the life processes by some of the lowest plants, the so-called organized ferments, that some of the most useful and some of the most deleterious products are due to their respiratory activity. In alcoholic fermentation, as clearly pointed out by Pasteur and Bernard (see 3 of references), the living ferment is removed from all sources of free oxygen, and in the efforts of the ferment for respiration the molecules of the sugar are decomposed or rearranged, and a certain amount of oxygen set free; and this oxygen supplies the respiratory needs of the ferment.

It has been found that the motile power of some bacteria, like *Bacterium termo*, depends on the presence of free oxygen in the liquid containing them. When this is absent they become quiescent. This fact has been utilized by Engelmann and others in the study of the evolution of oxygen by green and other colored water plants, the bacteria serving as the most delicate imaginable oxygen test; so that when the minutest green plant is illuminated by sufficient daylight the previously quiescent bacteria move with great vigor and surround it in swarms. Out of the range of the plant the bacteria are still or move very slowly as if to conserve the minute energy-developing substance they have in store until it can be used to the best advantage.

May we not now approach the problem directly and answer for the whole organic, living world the question, "What is

respiration?" by saying *it is the taking up of oxygen and the giving out of carbon dioxide by living matter.* This is the universal and essential fact with all living things, whether they are animals or plants, whether they live in the water or on the land. But the ways by which this fundamental life process is made possible, the mechanisms employed to bring the oxygen in contact with the living matter and to remove the carbon dioxide from it are almost as varied as the groups of animals, each group seeming to have worked out the problem in accordance with its special needs. It is possible, however, in tracing out these complex and varied methods and mechanisms to discover two great methods, the *Direct* and the *Indirect.* (See 8 of references.)

In the first there is the direct assumption of oxygen from the surrounding medium, and the excretion of carbon dioxide directly into it. The best examples of this are presented by unicellular forms like the amœba where the living substance is small in amount and everywhere laved by the respiratory medium. But as higher and higher forms were destined to appear, evidently the minute, organless amœba could not in itself realize the great aim toward which Nature was moving. There must be an aggregation of amœbas, some of them serving for one purpose and some for another. Like human society, as civilization advances, each individual does fewer things, becomes in some ways less independent, but in a narrow sphere acquires a marvellous proficiency. Or to use the technical language of science, in order to advance there must be *aggregation of mass, differentiation of structure and specialization of function.* Evidently, however, if there is an aggregation of mass, some of the mass is liable to be so far removed from the supply of oxygen and the space into which carbon dioxide can be eliminated that it is liable to be starved for the one and poisoned by the other. Nature adopted two simple ways to obviate this, first to form its aggregated masses in the shape of a network or sponge, with intervening channels through which a constant stream of fresh water may be made to circulate, so that each individual cell of the mass could

take its oxygen and eliminate its carbon dioxide with the same directness as its simple prototype, the amœba.

But in the course of evolution forms appeared with aerial respiration; and the insects among these solved the mechanical difficulty of respiration by a most marvellous system of air tubes or tracheæ extending from the free surface, and therefore from the surrounding air, to every organ and tissue. By means of this intricate network air is carried and supplied almost directly to every particle of living matter. The respiration is not quite direct with the insects, however, for the oxygen and carbon dioxide must pass through the membranous wall of the air tube before reaching or leaving the living substance.

In the next and final step, the step taken by the highest forms, the living material is massed, giving rise not only to animals of moderate size, but to the huge creatures that swarm in the seas, or walk the earth like the elephant. With all of these the step in the differentiation of the respiratory mechanism consists in the great perfection of lungs or gills, and in the addition of a complicated circulatory system with a respiratory blood, one of the main purposes being, as the name indicates, to subserve in respiration by carrying to each individual cell in the most remote and hidden part of the body the vital air, and in the same journey removing the poisonous carbon dioxide.

This has been called *Indirect Respiration*, because the living matter of the body does not take its oxygen directly either from air or water, but is supplied by a middle man, so to speak.

The complicated movements by which water is forced over the gills or by which the lungs are filled and emptied, and the great currents of blood are maintained; that is, the striking and easily observed phenomena of respiration are thus seen to be only superficial and accessory, only serve as agents by which the real and the essential processes that go on in silence and obscurity are made possible (see references).

So far I have attempted to give a brief resumè of the views on respiration that have been slowly and laboriously evolved

by many generations of physiologists, each adding some new fact or correcting some misconception; and I trust that this brief sketch has recalled to your minds the salient facts in our knowledge of respiration, and that it will give a just perspective and enable me, if I may be permitted, to briefly describe what I believe to be my own contribution to the ever accumulating knowledge of this subject.

In 1876–1877 Prof. Wilder (6–7), who may be said to have inherited his interest in the ganoid fishes directly from his friend and teacher, Agassiz, who first recognized and named the group, was investigating the respiration of the forms *Amia* and *Lepidosteus*, common in the great lakes and the western rivers. As his assistant it was my privilege to aid in the researches and to acquire the spirit and methods, as in no other way is it so readily possible, by following out, from the beginning to its close, an investigation carried on by a master. The results of that investigation were reported to this section in 1876, and form a part of the proceedings of the Association for that year. From that time until the present the problems of respiration in the living world have had an ever-increasing fascination for me, and no opportunity has been lost to investigate the subject. The interest was greatly increased by the discovery that a reptile—the soft-shelled turtle—did not conform to the generalizations in all the treatises and compendiums of zoology, which state with the greatest definiteness that all reptiles, without exception, are purely air breathing, and throughout their whole life obtain their oxygen from the air and never from the water. The American soft-shelled turtles (*Amyda* and *Aspidonectes*), at least, do not conform to this generalization, but on the contrary naturally and regularly breathe in the water like a fish, as well as in the air like an ordinary reptile, bird or mammal (8).

In carrying on the investigation of the respiration of the turtle there appeared for solution the general problem, which, briefly stated, is as follows: In case an animal breathes in both air and water, or, more accurately, has both an aerial and an aquatic respiration like the ganoid fishes *Amia* and *Lepidosteus*, like the soft-shelled turtles, the tadpoles and many other forms,

what part of the respiratory process is subserved by the aqueous and what by the aerial part of the respiration? So far as I am aware this problem had not been previously considered. It was apparently assumed that there were in these fortunate animals two independent mechanisms, both doing precisely the same kind of work, that is, each serving to supply the blood with oxygen and to relieve it of carbon dioxide as though the other was absent. That was a natural inference, for with many forms the respiration is wholly aquatic, all the oxygen employed being taken from the water and all the carbon dioxide excreted into it. On the other hand, in the exclusively air breathing animals, as birds and mammals, the respiration is exclusively aerial.

This natural supposition was followed in the first investigations on the respiration of the soft-shelled turtles, and while it was proved with incontestible certainty that they take oxygen from the water like an ordinary fish, that is, have a true aquatic in addition to their aerial respiration; there was altogether too much carbon dioxide in the water to be accounted for by the oxygen taken from it. Furthermore, upon analyzing the air from the lungs of a turtle that had been submerged some time the oxygen had nearly all disappeared and but very little carbon dioxide was found in its place, while, as compared with human respiration for example, a quantity of carbon dioxide nearly as great as that of the oxygen which had disappeared, should have been returned to the lungs. Likewise in Prof. Wilder's experiments with *Amia* (7), to use his own words: "Rather more than one per cent. of carbon dioxide is found in the normal breath of the *Amia*, but much more of the oxygen has disappeared than can be accounted for by the amount of carbon dioxide." Everything thus appeared anomalous in this mixed respiration, and instead of a clear, consistent and intelligible understanding of it there seemed only confusion and ambiguity. Truly these seemed like "bad experiments."

It became perfectly evident that the first step necessary in clearing the obscurity was to separate completely the two respiratory processes, to see exactly the contribution of each

mechanism to the total respiration. But this was no easy thing to do. In the first place the animal must be confined in a somewhat narrow space in order that the air and water which are known to have been affected by its respiration may be tested to show the changes produced in it by the respiratory process; in the second place the water has so great a dissolving power upon carbon dioxide that even if it were breathed out into the air it would be liable to be absorbed by the water; then some means must be devised to prevent the escape of the gases from the water as their tension becomes changed; and finally, the animal in the water must be able to reach the air. A diaphragm must be devised which would prevent the passage of gases between the air and water, and at the same time offer no hindrance to the animal in projecting its head above the water. As a liquid diaphragm must be used it occurred to me that some oil would serve the purpose; but the oil must be of peculiar nature; it must not allow any gases to pass from air to water or the reverse, it must not be in the least harmful or irritating to the animal under experimentation, and finally it must itself add nothing to either air or water. Olive oil was thought of and later the liquid paraffins. The latter were found practically impervious to oxygen and fulfilled all the other requirements, but unfortunately they absorb a considerable quantity of carbon dioxide. Pure olive oil was finally settled upon as furnishing the nearest approximation to the perfect diaphragm sought.[2]

The composition of the air being known, and a careful determination of the dissolved gases in the water having been made, the animal was introduced into the jar, and the water covered with a layer of olive oil from ten to fifteen millimeters thick. The top of the jar was then vaselined, and a piece of plate-glass pressed down upon it, thus sealing it hermetically. Two tubes penetrate this plate-glass cover, one connecting with the overlying air chamber and the other extending into the water nearly to the bottom of the jar. As the water and air were limited in quantity the shorter the time in which the ani-

[2]See Wm. Thörner on the use of olive oil for the prevention of the absorption of carbon dioxide. Repetorium der analytischen Chemie, 1885, pp. 15–17.

mal remained in the jar the more nearly normal would be the respiratory changes; the experiments were, therefore, continued only so long (one or two hours) as was found necessary to produce sufficient change in the air and the dissolved gases of the water to render the analysis unmistakable.

Proceeding with the method just described the results given in the following table were obtained:

Table of mixed respiration showing the number of cubic centimeters of oxygen removed from air und water, and the amount of carbon dioxide added to the air and the water.

	Oxygen.		Carbon Dioxide.	
	From air.	From water.	To air.	To water.
Ganoid fish (*Amia calva*) . .	65	10	22	53
Tadpoles (*Larval batrachia*) .	70	5	24	51
Soft-shelled turtle (*Amyda mutica*)	31	8	10	29
Bull frog (*Rana catesbiana*) .	183	4	110	77[3]

It requires but a glance at the figures in this table to see that the aerial differs markedly from the aquatic part of the respiration. Even in the frog, in which the skin forms the only aquatic respiratory organ, the tendency is marked. The law appears to be unmistakably this, viz., *that in combined aquatic and aerial respiration the aerial part is mainly for the supply of oxygen and the aquatic part largely for the excretion of carbon dioxide.* This law, which I stated in 1886 (8), has been

[3]The oxygen from both the water and the air and the carbon dioxide in the air were determined with exactness in all the experiments; but owing to the failure of some steps in the titration for the carbon dioxide in the water, the figures given for the *Amia* and the soft-shelled turtle are the calculated results, assuming that the respiratory quotient is one, as that is the relation found by analysis in the other cases. This table will be greatly extended when the results of the investigation now in progress are published.

confirmed by the repetition of old experiments and by many new ones during the present summer; it is also confirmed by the experiments made on *Lepidosteus* in a different way by Dr. E. L. Mark (9), and published in 1890. I therefore feel confident that this is the expression of a general physiological law in nature.

From the standpoint of evolution we must suppose that all forms originated from aquatic ancestors, ancestors whose only source of oxygen was that dissolved in the water. As the water is everywhere covered with the limitless supply of oxygen in the air, there being 209 parts of oxygen in 1000 parts of air as contrasted with the 6 parts of oxygen dissolved in 1000 parts of water, it is not difficult to conceive that in the infinite years the animals found by necessity and experience that the needed oxygen was more abundant in the overlying air, and that some at least would try more and more to make use of it. And as any thin membrane with a plentiful blood supply may serve as a respiratory organ to furnish the blood with oxygen, it is not impossible to suppose that such a membrane, as in the throat, could modify itself, little by little, with ever increasing efficiency; and that a part might become especially folded to form a gill and another might become sacular or lung-like to contain air. While I am no believer in the purely mechanical physiology which sees no need of more than physics and chemistry to render possible and explain all the phenomena of life, yet it is patent to everyone that although vital energy is something above and beyond the energies of physics and chemistry, still it makes use of those; and certainly dead matter forms the material from which living is built. So given a living thing, it in most cases moves along lines of least rather than greatest resistance, therefore if practically a limitless supply of oxygen may be obtained from the air and only a limited amount from the water, if any thing that might serve as a lung is present, most naturally the animal will take the oxygen from the air where it is in greater abundance and most easily obtained. On the other hand carbon dioxide is so soluble in water that practically a limitless amount may be excreted into it; and as it is

apparently somewhat easier, other things being equal, for it to pass from the liquid blood to the water than to the air it seems likewise natural that the gills should serve largely for the excretion of the carbon dioxide into the water. This is the actual condition before us in these, and I believe in all other cases, of mixed or of combined aerial and aquatic respiration. And I believe the fundamental law in respiration is, as stated above that whenever both water and air are used with corresponding respiratory organs, *the aerial part of the respiration is mainly for the supply of oxygen and the aquatic part largely for the getting rid of carbon dioxide.*

It is not difficult to see in an actual case like that of the Ganoid fishes (*Amia* and *Lepidosteus*) the logical steps in its evolution, by which this most favorable condition has been reached. A condition rendering these fishes capable of living in waters of almost all degrees of purity, and thus giving them a great advantage in the struggle for existence. But what can be said of the soft-shelled turtles, animals belonging to a group (Reptilia) in which purely aerial respiration is almost exclusively the rule? Standing alone this might be exceedingly difficult or impossible of explanation. The Batrachia (frogs, toads, salamanders, etc.,) all have gills in their early or larval stage, and most of them develop in the water, and are in the beginning purely aquatic animals. The adults must, therefore, in most cases repair to the water at the spawning season, and frequently in laying the eggs they must remain under the water for considerable intervals. Being under the water and the need of oxygen becoming pressing, there seems to be, by a sort of organic memory, a revival of the knowledge of the way in which respiration was accomplished when as larvæ their natural element was water, and they may take water into the mouth and throat. This may be done by as highly a specialized and purely aerial form as the little brown tree-frog (*Hyla pickeringii*) or the yellow-spotted salamander (*Amblystoma punctatum*). Another very interesting form, the vermilion-spotted newt (*Diemyctylus*), after two or three years of purely aerial existence, goes to the water on reaching maturity, and remains there the rest of its life, regularly

breathing both by its lungs and by taking water into its mouth. A still more striking example is given by Prof. Cope. The young Siren almost entirely loses its gills and later regains them, becoming again almost as completely aquatic in its habits as in the larval stage.

With these examples which may be seen by any one each recurring year, is it impossible or difficult to conceive that in the struggle for existence the soft-shelled turtles found the scarcity of food, the dangers and hardships of the land, greater than those in the water? On remaining constantly in the water, and advantageously submerged for most of the time, it gradually reacquired the power of making use of its pharingeal membrane for obtaining oxygen from the water and excreting carbon dioxide into it as had its remote ancestors. And further, is it not intelligible that with capacious lungs, which it can fill at intervals with air containing so large a supply of oxygen that it, like the other double or mixed breathers, should use its lungs to supply most of the oxygen and its throat to get rid of much of the carbon dioxide?

Indeed, it seems to me that if the evolution doctrine is a true expression of the mode of creation, then development may be in any direction that proves advantageous to an organism, even if the development is a re-acquirement of long discarded structures and functions (11).

In closing may I be permitted to say to the older biologists, to those familiar with the encouragements and inspirations that come with original investigation, that I trust they will pardon what to them is unnecessary personality or excess of detail in this address for the sake of the younger ones among us, to whom the up-hill road of research is less familiar. Judging from my own experience in listening to similar addresses by my honored predecessors, it is helpful to know, when one is beginning, something of the "*dead work*," the difficulties and discouragements as well as the triumphs in the advancement of science.

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EDITORIALS.

EDITORS, E. D. COPE AND J. S. KINGSLEY.

—THE meeting of the American Association for the Advancement of Science, which closed its session at Rochester, August 23, was remarkable for several things. One characteristic was the large preponderance of papers in the biological section. Not only was this section more abundantly supplied with matter than any other, but entomological and botanical clubs also held sessions almost continuously. It seemed to the section that it would not be possible in future to give time for all papers likely to be presented, so it was decided to divide it into a zoological and a botanical section, which should, however, have a joint session to hear papers of general interest. Another feature of the Association was the extraordinary management of the geological section, which seemed to have fallen into the hands of a clique who quite forgot to cooperate with the rest of the Association. The section spent nearly all of one session discussing an excursion which some of the members had taken the day before, in disregard of the printed programme, which announced that certain papers would be read. Numerous persons were much inconvenienced by this proceeding. Another session was adjourned before half the usual term had elapsed, although persons were present fully prepared to read papers as announced in the programme. On another day the alternative was presented the members of remaining after the dinner hour had arrived, or of submitting to a final adjournment, as some of the members had an excursion on hand for the afternoon. In order to finish the programme the section decided to remain and take a late dinner, rather than disoblige the excursionists. But the height of impropriety was reached when the chairman of the section left the meeting and asked the section to elect one of his friends chairman. The section promptly complied. The new chairman then appointed an important committee, in which the late chairman's name occupies a conspicuous place.

The arrangements for the meeting of the Association made by the citizens were excellent, and were carried out without interruption. Discussion of papers was active and interesting, and added much to the interest of the occasion.

—THE American table at the Zoological Station of Naples needs the prompt attention of American biologists. For several years Americans desirous of studying at Naples were dependent on the bounty of foreign governments, whose temporarily vacant tables we used. This state of affairs becoming known, a wealthy resident of Syracuse, N. Y., Major Alex. H. Davis, paid the greater part of the sum ($500) necessary for the rent of the table. Last year over half the amount was raised by subscription among American students and institutions, Major Davis making up the deficiency. As this gentleman is not a specialist in biology it is not to be expected that his subscription will be always forthcoming, and those most interested are asked to make up the entire amount this year. The American Association and the Society of Naturalists have subscribed hitherto, and there is no reason why the Bache Fund of the National Academy should not contribute an important part of the amount. There should be no question of the ability of this nation to support one table at the Biological Station at Naples.

—A RECENT article in "Nature" states that the vertebrate fossils collected by Prof. Marsh for the U. S. Geological Survey are to be shortly exhibited in the National Museum at Washington. Similar communications were made to newspapers in this country about a year ago. As no provision exists for the exhibition of these fossils in the U. S. National Museum these announcements are premature. One side of a small room is the only space at present occupied by the material in question, and it is safe to say that no other space has been yet provided. As the National Museum committed the error at its establishment of attempting an exhibit of modern human industries, as we pointed out at the time, the space for scientific exhibits is necessarily greatly curtailed. The necessities of this department require the erection of a new building, and until that is done it is safe to say that the vertebrate collections of the U. S. Geological Survey will not be exhibited.

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RECENT LITERATURE.

Eimer on the Origin of Striped Muscular Tissue.[1]—Prof. Eimer, of Tübingen, endeavors in this treatise to prove that the transverse striping of muscular tissue is due to increased energy of muscular contraction. He refers to the well-known fact that this character is seen in muscles which display the greatest energy, while the unstriped condition is characteristic of muscles of feeble and slow contractility. This is shown to be the case in many animals, some of the most striking illustrations being drawn from the Mollusca. Among the most important observations are those on the muscles of the Anthropoda. The author made the interesting observation that the thoracic muscles of the house-fly are, during the winter season of torpidity, unstriped, while with the advent of active life in spring the cross-striping appears, and is most developed in summer, the period of greatest activity. The various stages of development of the Zwischenscheiben and Mittlescheiben, which are to be seen not only in the same individual but in the same fibrilla, are traced and illustrated. It is also maintained that the longitudinal division of primitive simple muscular masses into fibrillæ is due to longitudinal stress; and still earlier in evolution that muscular tissue is differentiated from homogenous protoplasm by the same agency. These theses are sustained with much plausibility, and they may be regarded as an integral part of Neolamarckian doctrine. Prof. Eimer expresses his results in the following language: "The cross-banding is the permanent expression of contraction waves of the muscle mass caused by nervous stimulus. It appears to be in the fullest sense an acquired and inherited peculiarity."

Beecher's Studies of the Brachiopoda.[2]—This paper is the second of a series in which are published the results of a combined study of young and adult, living and fossil brachiopods. The facts and conclusions reached are of great interest, and are highly important to a clear understanding of the group.

[1]Die Entstehung und Ausbildung des Muskelgewebes insbesondere der Querstreifung derselbens als Wirkung der Thatigkeit betrachtet; von G. H. Th. Eimer. Separat Abdruck aus Zeitschr. f. wissensch. Zoologie, liii, Suppl. Leipzig, 1892.

[2]Development of the Brachiopoda, Part II. Classification of the Stages of Growth and Decline, by Charles E. Beecher (with Plate 1). Am. Jour. Sci., Vol. xliv, Aug., 1892.

The author applies Prof. Alpheus Hyatt's "Classification of Stages of Growth and Decline" to the brachiopods from the developing of the ovum to the old age of the individual. This classification works so well in this new application that it adds strength to it as a system.

Prof. Beecher reviews the existing knowledge of the embryology of brachiopods, rendering very clearly the progressive development of the shell and associated parts. Kutorgina is suggested as a radical of the strophomenoids. A close comparison is made of the reflected "collar" in developing Spirorbis, with the reflected mantle lobes in Cistella. Thecidium is considered as a surviving member of the strophomenoids, which group has previously been considered as extinct.

Important observations are made on the development of the deltidium, in which the author shows that it is primarily a plate formed on the dorsal side of the posterior or pedicle segment of the larva. In later growth the deltidium becomes ankylosed with the ventral valve, which grows around so as to include it. This conclusion is strengthened by collateral proofs of microscopical structure. Deltidial plates, on the other hand, he shows are developed by the unfolding of the ventral mouth lobes at the pedicle area. They therefore properly belong to the ventral valve.

A perforation in the umbo of the dorsal valve in many early articulate types leads to the conclusion that they had an anus. In brachiopods as a whole some features are progressive, others retrogressive. The protegulum[3] or larval shell is mentioned, but is fully discussed in the earlier paper.

Acceleration of development is clearly shown in Discinisca, which in the nepionic stage adopts characters which are first found in the nealogic stage of its ancestor, Orbiculoidea. Nice distinctions are made between characters acquired by inheritance and those adopted by special adaptations to conditions of environment, which latter may appear anywhere in separate genetic series. Postembryonic stages are briefly considered in types of the four orders proposed by the author.

Old age, or the geratologic period in brachiopods, is marked by the thickening of the valves, and may be further indicated by loss of ornamentation and resorption of the deltidium or deltidial plates. In the early forms of each genus and family the species are small, in the culmination they attain a maximum of size; before extinction they again resume a depauperate size and present abundant geratologous and pathologic forms. As such degraded types, Cistella and Gwynia, among brachiopods, bear such relations to the Terebratuloids as Baculites amongst cephalopods do to the Ammonoids.

ROBERT T. JACKSON.

[3]Comparable to the protoconch and prodissoconch of mollusks.

General Notes.

GEOGRAPHY AND TRAVELS.

The Peary North Greenland Expedition.—This expedition, together with the relief expedition, both sent out by the Academy of Natural Sciences of Philadelphia, has returned safely. They stopped at St. Johns, Newfoundland, and we derive the following report of their proceedings from letters sent to the *Record* and *Ledger* by Lieut. Peary and Mr. Meehan of the expedition,and from information subsequently obtained by ourselves.

Lieut. Peary has carried out his plans fully and made an inland ice journey of 1300 miles with Mr. Astrupp, and, through the members of his party who remained at McCormick Bay, has made a rich collection of the flora, fauna and ethnology of North Greenland, besides which he has demonstrated the ease and comfort with which a winter can be spent in the Arctic regions. The Relief Expedition has been equally fortunate. Not an essential plan projected by Professor Heilprin has miscarried, and many things have been accomplished not considered feasible before sailing. Throughout the voyage no serious mishaps occurred, and the collections made are probably unprecedented, even by many Northern expeditions remaining for a longer period of time. It made an almost complete collection of water and land mammals, both in skins and skeletons; a large variety of birds and submarine animal life, a collection of flowering plants, mosses, lichens and insects, and of ethnological specimens, which is probably only excelled by that in the museum at Copenhagen. This includes tents, costumes, sledges and dogs of the northern Esquimaux. The party has also secured meteorological and tidal observations, and a large number of photographs of natives, dwellings and arctic scenery.

Peary discovered what he went after—the northern boundary of the main mass of Greenland. The details of his journey are awaited with great interest.

The expedition was a success, among Lieutenant Peary's discoveries being one of a great bay, latitude 81.37, longitude 24, opening out east and northeast, which he named Independence Bay, in honor of the day, July 4; and the great glacier flowing north into it,

Academy Glacier, in honor of the Academy of Natural Sciences of Philadelphia, which sent out the expedition.

He succeeded in exploring the great fiords and glaciers emptying into Kane and Hall basins and Robeson channel, and Whale and Inglefield Sounds.

The record of the Peary party from the date of arrival in McCormick's Bay to its leader's return from the inland ice is a pleasant one. The winter quarters were completed soon after the Kite left last year, and named Red Cliff House, from the color of the rocks and Cape Cleveland. Numerous expeditions were made during the autumn to secure fresh meat for winter use. During one of these in August a family of Eskimos was induced to remove to Red Cliff House, and this family subsequently brought several others. These proved valuable aids to the Peary party in carrying out their plans. Mr. Peary's leg, which was broken last year, meanwhile improved rapidly, and by September 29 he was able to abandon crutches. During early autumn two reconnoissances of the inland ice were made, the first on September 7, by Astrupp, Gibson and Verhoeff, occupying five days, and the second on September 23, by Astrupp and Gibson, of seven days duration. The hunting expeditions, which lasted until November 8, when winter regularly set in, were eminently successful, no less than 53 reindeer having been secured, the skins of which were made into garments and sleeping bags. The long winter night was occupied in making sledges and other articles. Although the weather was very cold, the lowest temperature being minus 53 degrees, the party had no difficulty in keeping warm. When spring opened they had more than one ton of coal remaining of the seven tons left them, besides a large quantity of kerosene. The health of the members also was excellent, except during a short period, when Mr. and Mrs. Peary suffered from the grippe.

The sun showed itself on February 15th, and almost immediately provisions were gradually taken to the head of the bay, 15 miles distant, for the ice journey. On April 29th the work of transporting these to the edge of the inland ice began, Mr. and Mrs. Peary, with a few Eskimos, in the meantime taking a short boat journey to Inglefield Gulf to survey it.

On May 8th the ice journey began, the party comprising Peary, Astrupp, Gibson and Cooke—Henson and Verhoeff remaining behind with Mrs. Peary, the first on account of a frozen heel and the second to attend to meteorological work in which he had become greatly interested. At the start seven sledges of different patterns were taken,

but three of these were soon found unavailable and dropped. Twenty Eskimo dogs were also taken, but five of these had died by the time the party had gone 30 miles beyond the basin of the Humboldt glacier, which was reached on May 21st. At this point Mr. Peary selected Astrupp as his companion, took three of the sledges and 13 dogs and continued the journey, Cook and Gibson returning with one sledge and two dogs, arriving at the Red Cliffe House early on the morning of June 3d. After leaving Cook and Gibson, Peary and Astrupp pursued a northeast course, following along the Humboldt glacier, Peterman and Sherard Osborn Fiords, and succeeded in determining the northern boundary of the main land mass of Greenland.

Soon after the commencement of the journey two of the three sledges were discarded, and before its completion eight of the thirteen dogs died. The sledge which was used during the entire journey was ten feet long, sixteen inches wide and weighed thirteen pounds, and sustained without breaking a weight of 450 pounds. The principle food was pemmican, pea soup, bear's meat, tea and biscuit. No tent was used to harbor them from the winds, and even sleeping bags were after a time discarded, the fur clothing being considered sufficient protection for a greater part of the time. The weather was pleasant, except for the sharp winds, and but little difficulty was found by the two in keeping their course, except during fogs, which closely resembled the ice they were travelling on. They succeeded in making the entire journey in ninety days, the return being made in much shorter time than the forward movement.

Shortly after Mr. Peary's return occurred the only catastrophe of the expedition—the disappearance and possible death of Mr. Verhoeff. He was last seen on August 11, when he intimated his intention of visiting a neighboring settlement, a mineral territory well known to him. Having failed to appear within a reasonable time, fears for his safety were aroused and search was begun for him. In this the Peary party, the Relief Expedition and the crew of the Kite were engaged, besides nine Eskimos, who were stimulated to extra exertion by the offer of rifles and other articles valuable to them. The search, which was continued without intermission for seven days and nights, was so thorough that several small articles lost last spring were found, and finally traces of the missing man. There were footprints leading from the shores of Robertson's Bay up to a dangerous glacier. At its head were found a number of mineralogical specimens placed carefully on a rock, with drippings from a meat can and a piece of

string. Besides the heap of minerals, from the evidence discovered there was no doubt in the minds of the searchers that Mr. Verhoeff had been there and had fallen into one of the thousands of dangerous gulches which that glacier possessed, and was killed. Having completely traversed the country that was in any way accessible to Mr. Verhoeff, and convinced themselves of the futility of any further search, the expedition returned to McCormick Bay on the night of August 23, and on the following day started on the homeward journey.

GEOLOGY AND PALEONTOLOGY.

The Elevation of Mount Orizaba or Citlaltepetl.—Citlaltepetl (Star Mountain) is an old volcano situated on the eastern margin of the Mexican table land, about 19° north of the equator and about seventy-five miles from the Gulf. The slopes of the mountain have been known and occupied by man for many centuries, yet from a scientific standpoint they are comparatively unknown.

In July, 1891, a party consisting of Henry E. Seaton, Bloomington, Ind., botanist; A. J. Woolman, South Bend, Ind., ichthyologist; W. S. Blatchley, Terre Haute, Ind., entomologist; U. O. Cox, Mankato, Minnesota, ornithologist, and the writer, visited the Star Mountain, making interesting collections of the varied forms of life found on its slopes. The different members of the party will in due time report on the work done in the different departments.

The question of the highest elevation in North America seems to lie between Citlaltepetl in Mexico and St. Elias in Alaska, so that considerable interest centers on the determination of the exact elevation of these mountains.

Different observers vary considerably in their estimates of the elevation of Citlaltepetl; among many the following may be noted:

A. Von Humboldt, 17,375 feet. A Mexican scientific commission, 17,664 feet. Ferrer, 17,879 feet, which is the elevation given by some German geographers. Abmaran, 17,916 feet. Prof. A. Heilprin, 18,205 feet. Dr. Franz Kaska, 18,270 feet.

Prof. Heilprin used an aneroid barometer, adjusted by comparison with a standard mercurial barometer. The elevation of the City of Mexico was determined by railway levels, and the elevation of the summit of the mountain above the City of Mexico was determined by comparing nearly simultaneous barometrical readings, taken one on mountain and one in the city, about 125 miles away. The dis-

tance between the two localities is considerable and the atmospheric conditions are usually very diverse, yet the results are very close to those of Dr. Franz Kaska who used two mercurial barometers, of mountain form, read at about the same time, one on the summit of the mountain and one at Chalchicomula about twenty miles away. The elevation of the datum point in Chalchicomula was determined by railway levels.

From the datum point used by Dr. Kaska, assisted by Mr. O. G. Bunsen I carried a line of spirit levels up to the 14,000 feet level. Higher it did not seem practicable to go, on account of snow, steep slopes, high winds, etc. From that elevation we made two ascents, one on July 29, 1891, and one on August 3, 1891. I used an aneroid barometer adjusted by comparison with a standard mercurial barometer. On each ascent the barometer was read at the summit about 2 o'clock P. M., and at the 14,000 feet level at about 5 o'clock P. M. The readings for July 29, reduced by the method of the U. S. Coast Survey, indicated a difference in elevation between the 14,000 feet level and the summit of 4139.20 feet, while those of August 3 by the same method indicated a difference of 4219.12 feet. The average of these results 4179.16 feet plus 14,000 feet gives a total elevation of 18,179.16 feet, a result surprisingly near that of Prof. Heilprin. Prof. Heilprin estimated that his station was 120 feet below the summit. My aneroid barometer indicated that it was only eighty-six feet below the true summit; subtracting this difference of thirty-four feet from Prof. Heilprin's figures, and the two results 18,171 feet and 18,179 feet differ by only 8 feet.

The atmospheric conditions on July 29 and August 3, to the senses seemed identical, yet the difference as shown by the barometer was considerable, and the barometer, when checked with the spirit level elevations, gave varying results. These variations, while not wide, gave rise to a feeling of uncertainty as to the trustworthiness of the barometer in determining such high elevations.

In April 1892, assisted by Señor E. O. Moreno, I measured a base line 1550 feet long, near the 13,000 feet level and obtained the angles necessary to determine the elevation of the peak above each end of the base line, a large cross planted on the summit forming a definite point of observation. The results show an elevation of 18314.357 feet, as follows:

Railway levels from tide water at Vera Cruz to datum in Chalchicomula	8313.571 feet.
Spirit levels from Chalchicomula to Station A.	4696.188 feet.
Triangulation from Station A.	5302.267 feet.
Elevation via Station A.	18,312.026 feet.
Spirit levels from Chalchicomula to Station B.	4720.569 feet.
Triangulation from Station B.	5282.146 feet.
Elevation via Station B.	18316.687 feet.
Mean elevation	18314.357 feet.

It was a source of great satisfaction to Dr. Kaska and myself to find our results, obtained by different methods, so closely confirmatory and not widely different from the results obtained by Prof. Heilprin and myself with aneroid barometers. From the above results it seems safe to consider Mount Orizaba or Citlaltepetl as being about 18,300 feet high.

Popocatepetl (Smoking Mountain) about 100 miles west of Citlaltepetl is thought by many to be higher than the Star Mountain; but one who has ascended both peaks would certainly consider Citlaltepetl the higher elevation. Prof. Heilprin's observations made Popocatepetl about 700 feet lower than the Star Mountain, and my barometer indicated about the same difference, so that the honor of being the culminating point of North America clearly lies between the Star Mountain of Mexico and Mount St. Elias of Alaska.—J. T. Scovell, Terre Haute, Indiana.

Seeley on the Sauropterygia.—In the Proceedings of the Royal Society of Great Britain, Vol. li, p. 119, Prof. H. G. Seeley, F. R. S., gives a synopsis of the characters of the genera and families of the Sauropterygia which are found in the beds of the Jurassic and Cretaceous systems. He points out the fundamental character of the difference between the structure of the shoulder girdle in the Elasmosauridæ and Plesiosauridæ first insisted on by Cope, and regards the differences between the paradiapophyses of those families as of family significance instead of generic, as held originally by Cope. The previous paper of Prof. Seeley on the structure of the shoulder girdle of the European genera threw great light on the systematic of this order of reptiles, and the present paper increases that knowledge and establishes the taxonomy on a firm basis. He places the long necked and short necked genera in different families, a proceeding which may require revision, although of the generic value of such groups there

can be no doubt. The genera with divided cervical ribs are Plesiosaurus, Eretmosaurus, Rhomaleosaurus and Pliosaurus. Those with simple cervical ribs are Polyptychodon, Polycotylus, Cimoliasaurus, Stereosaurus, Mauisaurus, Elasmosaurus, Trinacromerum, Colymbosaurus, Muraenosaurus, Cryptoclidus. Thaumatosaurus he thinks is identical with Pliosaurus.

Dana on the Huronian System.—In the Amer. Journ. Sci. Arts, Prof. Dana makes some rational observations on the recent proposition of certain members of the U. S. Geological Survey to add a fifth division to the geological system of time under the name of the Algonkian era. He says: "The Algonkian (or Agnotozoic) beds belong either to the Archean or to the Paleozoic. The Archean division of geological time is of the same category with the Paleozoic, Mesozoic and Cenozoic; all are grand divisions based on the progress of life, and they include together its complete range. There is no room for another grand division between Archean and Paleozoic any more than for one between Paleozoic and Mesozoic. The so-called Algonkian is not above Cambrian in grade, it being based on series of rocks. Its true biological relations are in doubt, because fossils representing the supposed life of the period are unknown or imperfectly so. The discovery in any rocks so-called, of Trilobites, Crustaceans, Molluscs, Brachiopods or Crinoids, whatever the species, would entitle such rocks to a place in the Paleozoic, and either within the Cambrian group or below it. Walcott has already reported such fossils from the beds at the bottom of the Colorado canyon referred by him to the Algonkian, namely: besides a Stromatopoid, a small Patella-like or Discina-like shell, a fragment of a Trilobite and a small Hyolithes, forms which make the beds Paleozoic beyond question" (p. 460, June No., 1892).

Geological News.—Mr. Whitman Cross, in a late number of the Amer. Journ. Sci. Arts, endeavors to set forth the state of our knowledge of the stratigraphy and incidentally paleontology of the Laramie formation. He thinks it probable that the alleged Laramie includes several formations, which are distinguished by unconformity and lithological diversity. He gives a very thorough review of the literature of the subject.

—The appropriation for the U. S. Geological Survey was much reduced by the last Congress. Nearly forty members of the present force will be asked to resign. Washington dispatches to the newspaper press

state that this list includes three $4000 geologists, one $3000 geologist, two $2400 geologists, two $2000 geologists, one $2000 chemist, two $2500 geographers, one $2000 topographer and one $3000 officer, classed as a general assistant. These are dropped altogether, as is also vertebrate paleontology. Twenty-six other employees will also have to submit to a reduction of pay. Major Powell, Chief Director of the Bureau, says that six of the scientists thus summarily disposed of have volunteered to stay and complete the work they are employed upon without present compensation, and seventeen others have already secured professorships in various colleges and other educational institutions. He adds that the reduction of force will compel him to drop some branches of the work upon which he has been engaged, but he believes he will be able to struggle along until Congress reassembles in December.

—The northwestern division of the Geological Survey of Texas is under charge of Mr. W. F. Cummins. Mr. Cummins' party has explored during the present season the formations which appear along the eastern border of the Staked Plains, and is at present examining the Permian formation along the waters of the Red River.

MINERALOGY AND PETROGRAPHY.[1]

Thermometamorphism.—A very brief but extremely interesting review of the effects of thermometamorphism in the acid and basic lavas in contact with granite and granophyre in the Lake District, Eng., is given by Harker.[2] The altered zone surrounding the latter rocks is about $\frac{3}{4}$ of a mile wide. On its outer periphery only the secondary constituents of the basic lavas have been affected by the contact action. This leads the author to the statement that the substances most susceptible to thermal agency are those formed under ordinary meteoric conditions, minerals of direct igneous origin being more refractory. In the rocks under discussion but little change in chemical composition has taken place as a consequence of their metamorphism, except that there is a loss of water and a gain in boron quite near the contact. The mineralogical changes noted are the production of biotite from the chloritic decomposition products of pyroxene and the formation of clear feldspar from the original turbid mineral. In addition to these, quartz, green hornblende, actinolite, tremolite, augite, sphene, rutile, magnetite and pyrite have also resulted from the metamorphic processes. The characteristic contact minerals of sedimentary rocks, cyanite, andalusite and garnet are practically absent. Their abundant presence in sedimentary rocks is thought to be due to the fact that these contain but a small proportion of alkalies, as a result of the long continued chemical degradation to which they have been subjected, and that since feldspar, which the author regards as a characteristic contact mineral, could not form, only aluminous new products are possible. The careful study of the altered rocks indicates that there was very little interchange of substance between different portions of the original rock, except between those parts that were immediately adjacent. The preservation of minute structures, such as fluxion lines and spherulitic aggregates, point to this conclusion. In the case of the acid lavas the material very near the metamorphosing mass consists principally of a fine-grained aggregate of feldspar and quartz. Aluminous and ferruginous compounds were absent from the original lava; they are likewise absent from its altered phases.

[1]Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

[2]Bull. Geol. Soc. Amer., Vol. iii, 1892, p. 16.

Cellular Epidote in Granite.—Three granite sections from Wrangell Island, Alaska, the Pelly River in the Yukon District, and from the Stikine River, in the Coast Range of British Columbia, are described by Adams[3] as exhibiting several interesting peculiarities. All possess large quantities of epidote, which has a rudely outlined crystal form. In the specimen from the first mentioned locality the epidote is intergrown with allanite, with the latter on the interior. The most peculiar feature in connection with the epidote is its cellular structure, it being merely a skeleton of this substance enclosing small, elbow-shaped areas of quartz, feldspar, etc. Calcite and muscovite grains were noted with the same structure. In the case of the mica the inclusions occupy such a large portion of the area enclosed within the outline of the mineral that the muscovite appears as an assemblage of detached fragments, optically continuous with one another. Upon discussing the origin of the cellular minerals the author is compelled to the conclusion that they have all been formed since the consolidation of the rocks in which they occur. Since these all show evidence of having undergone slight crushing, it may be that the growth of the minerals is dependent somehow upon the reactions set up during the crushing. As all the constituents in these granites are fresh, the conclusion that the calcite, muscovite and epidote are secondary is an interesting one.

Petrographical Notes.—In an article descriptive of Chilean ore deposits Möricke[4] gives a few petrographical notes on a hornblende-biotite granite, a tourmaline granite, a quartz diorite, a quartz porphyry, and two other rocks of special interest. One is a quartz tourmaline rock in which a sort of groundmass of the former mineral encloses small idiomorphic crystals of the tourmaline. It is presumably an eruptive. The other is a perlitic pitchstone from Guanaco, with large phenocrysts of plagioclase and sanidine and a few flakes of biotite. Its unique feature is the possession of gold in skeleton crystals scattered through the glassy matrix, enclosed in the spherulites and included in the fresh feldspar.——Masses of an azure blue saccharoidal[5] rock occur imbedded in a granular serpentine at a point on the Gila River, 40 miles west of Silver City, N. M. In the thin section these masses are found to be composed of a granular, colorless

[3]Canadian Rec. of Sci., Sept., 1891, p. 344.

[4]Min. u. Petrog., Mitth. xii, p. 195.

[5]Merrill and Packard. Amer. Jour. Sci., April, 1892, p. 279.

pyroxene intermingled with calcite, with the pyroxene more or less altered into serpentine. A fragment of the rock free from calcite and serpentine gave: $SiO_2 = 54.30$; $MgO = 18.33$; $FeO = 1.11$; $CaO = 25.00$, a composition corresponding to $Ca\,Mg\,(SiO_3)_2$. The blue color is supposed to be due to the ferrous iron present in the pyroxene.

Two New Rocks.—Boninite is a bronzite limburgite from Peel Island, one of the Bonine group, near Japan. It is described by Petersen[6] and Kikuchi[7] as consisting of phenocrysts of olivine, bronzite and a few augites imbedded in a glass full of crystallites, some of which are sanidine. The rock is closely related to sanukite.[8] Mijakite from Mijakeshima is an andesite with a reddish brown pyroxene, supposed to be triclinic, feldspar and glass, forming a groundmass in which are porphyritic crystals of bytownite, a little augite, hypersthene and biotite. The composition is:

SiO_2	Al_2O_3	Fe_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	Loss	Total.
50.87	21.98	5.85	5.09	1.45	1.38	9.12	2.85	22	.43	= 99.24

Optical Anomalies.—In a prize volume[9] issued by the Fürstlich Jablonowski Society of Leipzig, Brauns discusses critically and in great detail the various theories proposed in explanation of optical anomalies and gives a resumè of all the work done on individual minerals exhibiting the phenomena. About seventy substances in which anomalies have been discovered are treated in the second part of the volume, while in the first part the space is devoted to the historical and critical discussion of the theories. The anomalous bodies are divided into five groups according as the cause of their peculiarities is differently orientated lamellæ; dimorphous enantiotropism of their substance, strain, isomorphous mixture or loss of water. In an appendix are grouped those minerals the cause of whose anomalies is unknown.——Pyrenaite, the black garnet occurring in a black limestone at the Pic d'Eres Lids, Pyrenees, show such regular anomalies that Mallard[10] is enabled to determine the optical constants of the sub-

[6]Jahrb. Hamburg. wissensch. Anst. viii, 1891, p. 1.

[7]Jour. Coll. of Sci., Imp. Univ. Japan, iii, 1889, p. 67. Ref. Neues Jahrb. f. Min., etc., 1892, i, pp. 311 and 313.

[8]AMER. NATURALIST, 1891, p. 368.

[9]Die Optischen Anomalien der Krystalle. Leipzig, S. Hirzel, 1891. Pl. 6, pp. 10 and 370.

[10]Bull. Soc. Franç. d. Min., xiv, p. 293.

stance whose six orthorhombic pyramids build up the perfect dodecahedral crystals. Its mean index of refraction is 1.74 and its optical angle 2 V = 56° 5′. The author regards his observations as settling the question as to the cause of optical anomalies in garnet in favor of his own theory and in opposition to the theories of Klein and of Brauns, the former of whom regards them as due to the dimorphism of the garnet molecule and the tension resulting from its attempt to pass to a more stable form than that in which it crystallized, and the latter as due to isomorphous mixtures.

Examination of thin sections of beryl crystals from the Ilmengebirge in the Urals leads Karnojitzky[11] to the belief that the anomalies discoverable therein are dependent directly upon the limiting faces of the crystals. When these differ the character of the internal structure differs, as is also often true in the case of garnet. An optically anomalous beryl crystal consists of several elemental individuals, the number and position of which correspond closely with the number and positions of the limiting planes of the crystals. The positions of the individuals preclude the notion of twinning. The author thinks the anomalies due to the isomorphous mixture of the beryl substance with some other, probably tourmaline.——In a section of dioptase cut parallel to the base the same investigator[12] found uniaxial areas distributed among the normal biaxial areas in such a way as to convince him that the interior structure of the mineral is determined to some extent by its exterior form, as in the case of the beryl.

Mineralogical News.—Genth and Penfield[13] have obtained *hübnerite* crystals from two localities near Silverton, Col., from White Oaks, N. M., and from Nye Co., Nev. Those from the North Star Mine, near Silverton, were doubly terminated, so that by their measurement the axial ratio, .8362 : 1 : .8668, was determined. Cleavage sections parallel to $\infty P\bar{\infty}$ extinguish at about 17° from c in the obtuse β, which direction is the axis of least elasticity. Pleochroism is marked, being green parallel to C and yellowish brown parallel to B. Density is 6.713 and composition $WO_3 = 74.75$; FeO = 2.91; MnO = 21.93; CaO = .11; MgO = tr. *Bismuthite* from the phenacite locality of Mount Antero, Col., and *hessite* from the Refugio Mine, Jolisco, Mex., are also briefly described by the same authors. They were, however, too impure to yield good analytical results. A *natrolite*

[11]Zeits. f. Kryst., 1891, xix, p. 209.

[12]Ib., 1891, xix, p. 593.

[13]Amer. Jour. Sci., March, 1892, p. 184.

associated with eudialite, etc., at Magnet Cove, Ark., is in large colorless crystals whose analysis gave: $SiO_2 = 47.97$; $Al_2O_3 = 26.51$; $Na_2O = 15.98$; $H_2O = 9.81$.

Yeates and Ayres[14] have come into the possession of sufficient quantities of *plattnerite* to enable them to describe it in some detail. The mineral is associated with limonite and white pyromorphite at the "You Like" lode, near Mullan, Idaho. The pyromorphite is in veins cutting nodules of the plattnerite and in little crystals imbedded in them. The color of the lead oxide is iron black. Its streak is chestnut-brown, its hardness 5.5 and density 8.56. An analysis showed the following composition: Pb = 83.20; Ag = tr.; Cu = .14; Fe Al = 1.20; O = 12.93; Ins. = .82, besides Ca and Mg. Upon breaking open some of the nodules little cavities were found in it, whose walls were covered by druses of tiny crystals. These plattnerite crystals are tetragonal and isomorphous with the members of the rutile group. $a : c = 1 : .67643$. They are prismatic with $\infty P\infty$, $3P\infty$ and sometimes oP and $\frac{3}{2}P$.

In another contribution to the discussion of the constitution of micas and chlorites Clarke and Schneider[15] communicate results of analyses of *waluewite*, *clinochlor* and *leuchtenbergite* from Slatoust, of diallage *serpentine* from Syssert, and of white *mica* from Miask, in the Urals. One of the conclusions based upon the action of the chlorites toward reagents is to the effect that their composition cannot be explained in terms of the Tschermak theory.

At Placerville, Eldorado Co., Cal., is a vein of quartz cutting quartzite. The vein is much decomposed and contains pockets of red earth in which are numbers of *quartz*[16] crystals, some of immense size. Many bear inclusions of chlorite arranged in zones marking successive stages of growth, and others contain hollows that are moulds of groups of some rhombohedral mineral, probably siderite. *Brookite* and *octahedrite* are also found in these pockets, sometimes loose in the clay, sometimes implanted upon the quartz or included within it. In the same article there is described an immense *monazite* crystal from Perm, Russia, and enormous rubies from Moguk, near Mandalay, Burma.

The *bournonite* of Nagybanya, in Hungary, is associated with zinc, lead and other sulphides, siderite and quartz. According to A. Schmidt[17] two types of the bournonite occur, the prismatic and the

[14] Ib., 1892, May, p. 407.

[15] Ib., 1892, p. 378.

[16] Ib., Feb., 1892, p. 329.

[17] Zeits. f. Kryst., xx, p. 152.

tabular, both of which are rich in forms. Two new planes $\frac{1}{3}P\breve{\infty}$ and $2P\breve{\infty}$ raise the number of forms known to occur in the species to 75.

In the carbonaceous mica schists near the contact with granite in the Müglitzthal, S. E. of Dresden, Beck[18] has discovered small crystals of *brookite*. The original rock from which the schists were made contained rutile needles. These afforded the material for the brookites, which are found lying with their flat sides parallel to the cleavage planes of the schists.

The striations parallel with and perpendicular to the octahedral edges of the *magnetite* crystals from Mineville, N. Y., are ascribed by Kemp[19] to etching agents. The striations parallel to the edges are usually referred to twinning, but in the present case it is probable that Kemp's explanation is the correct one, for when unstriated crystals are subjected to the influence of HCl and H_2SO_4 they become covered with striations like those occurring in nature.

A lot of very pure *cordierite* from coarse veins cutting gneiss at Guilford, Ct., has been analyzed by Farrington,[20] who finds in it:

SiO_2	Al_2O_3	Fe_2O_3	FeO	MnO	MgO	H_2O
49.44	32.97	.35	5.11	.32	10.39	1.65

corresponding to H_2O, 4(Mg Fe)O, 4 Al_2O_3, 10 SiO_2.

Treadwell[21] has made a new analysis of *milarite* that yielded him:

SiO_2	Al_2O_3	CaO	K_2O	Na_2O	H_2O	MgO
72.79	10.12	11.32	4.32	.26	1.19	tr.

This corresponds to R_2O, 2 CaO, Al_2O_3, 12 SiO_2.

Scalenohedral and prismatic crystals of *calcite* from Niederrabenstein, in Saxony, are described by Beckenkamp.[22] The prismatic ones are tetartohedral and hemimorphic.

Miscellaneous.—Dunnington,[23] after careful quantitative analyses of seventy-two soils from various localities as widely separated as the Sandwich Islands and Palestine, comes to the conclusion that all

[18]Neues Jahrb. f. Min., etc., 1892, i, p. 159.

[19]Zeits. f. Kryst., xix, p. 193.

[20]Amer. Jour. Sci., Jan., 1892, p. 13.

[21]Neues Jahrb. f. Min., etc., 1892, i, p. 167.

[22]Zeits. f. Kryst., xx, p. 163.

[23]Amer. Jour. Sci., Dec., 1891, p. 491.

contain titanium, which of course must necessarily exist as widely spread in the rocks from which the soils were made.

Small crystals of *melilite* have been detected by Bödländer[24] in a mass formed by the melting of Portland cement in an oven with a lining containing 63%–88% of SiO_2. The raw materials used as the charge consisted of a mixture of magnesia, limestone and clay. The crystals were imbedded in a mass of olivine(?), magnetite, mica and apatite. The crystals were found to be optically positive and to have the composition :

SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	K_2O	Na_2O
37.96	9.46	2.93	34.75	12.77	1.53	.64

Becke[25] gives brief but very definite directions as to the use of his method of distinguishing between quartz, orthoclase and plagioclase by etching with hydrofluoric acid and staining their etched surfaces.

Schrauf[26] describes a method of combining microscope and reflection goniometer in such a way that minute crystals may easily be studied and measured.

[24] Neues Jahrb. f. Min., etc., 1892, i, p. 53.

[25] Min. u. Petrog., Mitth. xii, p. 257.

[26] Zeits. f. Kryst., xx, p. 90.

BOTANY.

Botany at the Rochester Meeting.—There was so much Botany at the Rochester meeting of the American Association for the Advancement of Science that the space here given will scarcely more than admit of a catalogue of the papers and their authors. The botanical work was divided into that of the section and of the club. Section F at the Rochester meeting included all papers which came under the broad head of biology, and of these the total was no less than fifty-seven, a large share being upon botany. At the Washington meeting there was a proposition made to divide the section into two, namely one for zoology and one for botany. After a thorough canvass of the subject in the Section the council finally voted unanimously to recommend such a division and it was made by the Association. The new Section of Botany takes the letter G, and hereafter botanists will be by themselves in Section G.

The first two papers in the Section were by Dr. N. L. Britton upon—"Notes on *Ranunculus repens* and its Eastern North American Allies" and "Notes on a Monograph of the North American species of Lespedeza". A large number of specimens were shown which enforced the position taken by the author. Mr. W. W. Rowlee instructor in Botany at Cornell University presented a paper upon "The Root System of *Mikania scandens*, in which the strange development of a mass of fibrous roots was brought out. Specimens were shown of the bog water masses of roots. Prof. L. M. Underwood gave a "Preliminary comparison of the Hepatic Flora of boreal and sub-boreal regions" showing many points of difference.

Dr. E. F. Smith gave two papers bearing upon his long prosecuted labors namely—"On the value of wood ashes in the treatment of peach yellows" and "On the value of superphosphates and muriate of potash in the treatment of peach yellows". The genuine "yellows" is not cured by the use of plant food and is a specific disease. When asked for the cause of the trouble Dr. Smith replied that he wished he knew.

Prof. Macloskie presented "Notes on Maize" and advocated this plant as worthy of becoming the "National flower"—"Spikes of wheat bearing abnormal spikelets" was a paper by Dr. Beal, as also the following—"A study of the relative length of the sheaths and internodes of grasses for the purpose of determining to what extent

this is a reliable specific character". Both papers were fully illustrated by specimens and wall charts.

Mr. Rowlee's second communication was "Adaptation of seeds to facilitate germination" in which he showed that many structures apparently for dissemination were for holding water or otherwise aiding in germination. Dr. H. L. Russell in "Bacteriological investigations of marine waters and the sea floor" showed that microörganisms exist in great numbers in the deep sea and that such forms offer many advantages for the study of physiological problems. Mr. T. V. Coville gave a "Sketch of the flora of Death Valley, California," where he has spent some time in the study of the strange forms. "How the application of hot water to seeds increases the yield" was shown by Dr. J. C. Arthur. The hot bath stimulates the development of a ferment and this quickens the seed to greater vitality and growth. Prof. L. H. Bailey "On the supposed correlation of quality in fruits—a study in evolution", showed that cultivated fruits are an improvement in flavor as well as in size over the wild forms from which they came.

A second paper by Dr. Russell was upon "Non-parasitic bacteria in vegetable tissue". There was some discussion following it, upon the method of penetration of organisms through vegetable tissues, the continuity of protoplasm offering the best explanation.

Prof. Kellerman's two papers were "Notes on yellow pitch-pine—*Pinus rigida* Mill., var. *lutea* Kell., n. v." and "Germination at intervals of seed treated with fungicides" the latter showing some striking results. In his study of "The fertilization of pear flowers". Mr. M. B. Waite found that the barrenness of orchards in some cases can be explained by the impotency of self-pollination.

Mr. T. B. Maxwell presented the results of "A comparative study of the roots of Ranunculaceæ." In "Adaptation of plants to external environment" Prof. W. P. Wilson, by means of a large number of lantern slides showed the influence of heat, light, high altitude, etc., upon the position of leaves upon various species of plants. Prof. S. A. Beach presented "Notes on self-pollination of the grape" and showed that some sorts need foreign pollen. "The comparative influence of odor and color in attracting insects" was brought out by Mr. G. B. Sudworth. "Notes on *Daucus carota*" were given by Prof. C. W Hargitt. A second paper by Mr. Coville, "Geographic relationship of the flora of the high Sierra Nevada, California," gave further results of the author's studies in the far west. Rev. W. M. Beauchamp presented "Variation in native ferns," followed by D. G. Fairchild on "Live-forever eradicated by a fungous disease," a rare instance of a

weed being successfully exterminated by a parasite. In the absence of the author, Dr. Vasey's paper upon "Otto Kuntze's changes in the nomenclature of North American grasses" was read only by title. A combination paper by Messrs Fernow and Sudworth upon "Revised nomenclature of the arborescent flora of the United States" was passed with a few remarks by Prof. Fernow, stating that the subject matter had been disposed of in the Botanical Club. A third paper by Mr. Coville was upon "Characteristics and adaptations of desert vegetation." In his absence, Mr. F. Roth's paper "Shrinkage of wood as observed under the microscope" was passed, as likewise two sent by Prof. Pammel upon "*Peziza sclerotium*" and "Temperature, and some of its relations to plant life." The "Pleospora of *Tropæolum majus*," "Secondary spores of anthracnoses" and "A bacterium of Phaseolus" were read by B. D. Halstead. Prof. Meehan's paper, "The significance of cleistogamy," in the author's absence was read by title, thus closing the schedule of botanical papers of Section F, with a total of thirty-eight papers.

The Botanical Club held many meetings and they were largely attended. In the absence of the president, Prof. Spalding, Dr. H. H. Rusby was elected to the chair. Mr. Coville presented a paper upon "Range, locality, station, and habitat." After considerable discussion the conclusion seemed to be that "range" was the region over which a species naturally grows; "locality," the geographic position of the species; "station," the spot where the species occurs, and "habitat," the kind of place where the individual specimens grow.

Thomas Morong gave a paper upon "Travels in Paraguay, and its flora." Dr. Rusby, also an exploring botanist, remarked upon the trials and dangers of such work. Prof. Underwood showed "A variety of *Polypodium vulgare* L., new to America."

The paper by Mr. Maxwell on "Symbiotic growths in the roots of Ranunculaceæ" brought out many questions, particularly from the mycologists. "Some rare and interesting fungi from Florida" were shown by Mr. Swingle and fully discussed.

Mr. Morong's second paper "Observations upon certain species of Asclepiadaceæ as insect traps" was discussed by Dr. Beal and others, after which Dr. Vasey gave a full account of the work of the Botanical division of the U. S. Department of Agriculture.

Dr. Arthur spoke next of the Botanical Congress at the World's Columbian Exposition, and the subject was considered at length and a committee appointed to confer with officers of the new section of botany in the matter. Mr. O. F. Cook who has recently returned from

Africa gave the next paper upon "General notes on the cryptogamic flora of Liberia."

A large portion of the sessions was taken up with the consideration of the important subject of nomenclature. A committee was appointed early in the meeting and its report fully considered. While space will not allow the whole of the conclusions arrived at, the following are given as showing the thoroughness of the work: "Publication of a genus consists only (1) in the distribution of a printed description of the genus named; (2) in the publication of the name of the genus and the citation of one or more previously published species as examples or types of the genus with or without a diagnosis." The "publication of a species consists only (1) in the distribution of a printed description of the species named; (2) in the publishing of a binomial, with reference to a previously published species as a type."

The following are some of the papers presented at the Club: "Some of the rare mosses of White Top and vicinity, recently collected on a trip to Southwestern Virginia, with specimens," by Mrs. E. G. Britton; "Galvanotropism," by Dr. Arthur; "Anatomy as a special department of Botany," by Miss Gregory; "A botanical terminology," by A. A. Crozier; "Notes on some pear and apple diseases," by B. M. Waite; "Modifications of the tomato fruit resulting from seed selection," E. S. Goff; "Cultivated species of Bassica," by L. H. Bailey; "Notes on the mountain flora of Northern Alabama," by Dr. Mohr; "Notes on the distribution of plants in Florida," by P. H. Rolfs; "North American Cacti," by Prest. Coulter; "On the proposed handbook of mosses of Eastern America, with specimens," by Mrs. Britton; "Weeds and weed roots," by B. D. Halsted; "The re-discovery of *Juncus cooperi*," by F. V. Coville; "Some general questions in the classification of Myxomycetes," by O. F. Cook; "The North American Amelanchiers," by N. L. Britton; "Observations on the North American species of Orchidaceæ and their nomenclature," by Thos. Morong; "A new form of root cage," by J. C. Arthur; "The botanical garden movement in New York," by N. L. Britton; "A few additions to the hepatic flora of the Manual region," by L. M. Underwood; "Notes upon a revision of the North American Naidaceæ," by Thos. Morong; "On the genus Campylopus in North America," by Mrs. Britton; "Some noteworthy features of the flora of West Virginia," by Dr. Millspaugh; "Notes on a recent outbreak of peach yellows near Ann Arbor, Mich.," by A. A. Crozier; "Some observations on *Epigea repens*," by Dr. Wilson; "Notes on some species of Cratægus," by Dr. Britton; "Observations on the ripening of the seeds of

Cuphea," by Mrs. Wolcott; "On the genus Ditrichium in North America, with one western species, and corrections for two eastern species," by Mrs. Britton; "Notes on terminology," by Thos. Holm; "Notes on some fungi common during the season of 1892, at Ames, Ia.," by L. H. Pammel; "Notes on some Kansas weeds," by A. S. Hitchcock; "Notes on the flora of Block Island," by W. W. Bailey; "Notes on the distribution of a few plants," by L. H. Pammel also "Phænological notes for 1892," by Prof. Pammel. This is a total of forty-one papers for the club. These with the thirty-eight named as on the programme of Section F give a grand total of seventy-nine papers presented at Rochester by the botanists. Many others not here mentioned were given before the Microscopical Society and the Society for the Promotion of Agricultural Science, so that it is safe to state that the number of botanical titles at the several conventions held at Rochester during ten days was in the neighborhood of, if it did not exceed, one hundred.

It was evidently the botanist's meeting, and with a new section established for them in the A. A. A. S., the workers upon plants, in all the various departments, may well feel encouraged to go forward to greater triumphs in the near future.—Byron D. Halsted.

Citation of Authors of Genera and Species.[1]—In order to obtain stability of nomenclature it is necessary to provide that the name of a plant, the specific name, cannot be changed through caprice or whim. Nor can it be changed through ignorance, providing the mistake through which the name was made has been discovered. The refusal to correct mistakes and the disinclination to do thorough bibliographical work before publishing a new specific name is the cause of most confusion in botanical nomenclature. Hence has arisen the so-called international law or law of priority which provides that the earliest published specific name of any plant must stand, providing that the name is not antedated by some other similar name applied to a plant belonging in the same genus. Many botanists do not admit the validity of this principle except in the case of species which they may have themselves named and published. With reference to others they are accustomed to insist that "customs," "long established habit" and a conservative condition must be maintained. This is to save the difficulty of having to revise their own systems of nomenclature, and serves in many cases to cover inaccuracies or hastiness. With this

[1]From "The Metaspermæ of the Minnesota Valley," in Report of the Geological and Natural History Survey of Minnesota (1892).

conservative position, the unthinking and unbotanical are always distinctly satisfied and are accustomed to declare that botanical nomenclature is purely a "practical matter" and should be taken out of the hands of the botanists altogether and turned over to some unprofessional commission for settlement. Objections of this sort are natural, for the changing of names in our accustomed department of science is always a confusing matter. Such criticism is, however, unthinking and unbotanical because it fails to recognize that the whole difficulty has originated on account of just such conditions as are extolled and recommended for perpetuation. The only way to obtain a stable nomenclature is by rigidly enforcing the law of priority with reference to specific names. All instability finds its well spring in the disregard of this law, and stability under our present general system of nomenclature can only be obtained by strict adherence to the oldest available specific name, by whomever or wherever it may have been published.

The cause of the present upheaval in plant nomenclature, signalized but not at all initiated, by such a book as that of Kuntze, is very easy to discover. Never so much as to-day has botany become world-wide. The multiplicity of periodicals, the facilities for exchange and correspondence between different countries, expeditions, congresses, communications, the development of new centers of activity in all parts of the globe, all conspire to make insularity of nomenclature impracticable, except for those who do not care to be within the pale of modern conditions. It was a matter of less importance fifty years ago, if the name *Potamogeton pauciflorus* was given to one plant in France, by Lamarck, and to quite a different plant in America, by Pursh. There was less danger of confusion, for French botanists and American botanists were not then so distinctly interested in each other's field. The international character of science was recognized long ago in the adoption of an international language—Latin—in which oriental and occidental investigators can communicate, whatever their native dialect. The law of priority simply carries this recognition farther, and provides that in the department of nomenclature Latin shall be used in the same sense in all countries.

In America the rightful implication of the law of priority has been ably expounded by Britton and Greene, seconded by many others. Under their leadership most of the younger school of botanists have determined to enlist, but the older men whose life works have been largely accomplished under the older and insular interpretation, the provincial dispensation, as it may be named, have in most cases failed to withdraw from the position of their youth—the "position of nam-

ing-plants-as-one-pleases"—and their publications are in consequence marred by the illegal nomenclature. Manuals and handy reference floras, most local lists and many monographs have perpetuated the faulty and insular methods and it is but very recently that a concerted attempt is being made to establish this department of botanical work upon the only sure foundation possible without a complete withdrawal from the existant system.—CONWAY MACMILLAN.

Rules of Botanical Nomenclature.—It is with great pleasure that we print the following rules of botanical nomenclature, as adopted by the Botanical Club of the American Association for the Advance-of Science, at a meeting held in Rochester, August 19th, 1892. We trust that they will be generally accepted by American botanists.

Resolved: That the Paris code of 1867 be adopted, except where it conflicts with the following:

I. THE LAW OF PRIORITY.

Priority of publication is to be regarded as the fundamental principle of botanical nomenclature.

II. BEGINNING OF BOTANICAL NOMENCLATURE.

The botanical nomenclature of both genera and species is to begin with the publication of the first edition of Linnæus "Species Plantarum," in 1753.

III. STABILITY OF SPECIFIC NAMES.

In the transfer of a species to a genus other than the one under which it was first published, the original specific name is to be retained, unless it is identical with the generic name or with a specific name previously used in that genus.

IV. HOMONYMS.

The publication of a generic name or a binomial, invalidates the use of the same name for any subsequently published genus or species respectively.

V. PUBLICATION OF GENERA.

Publication of a genus consists only (1) in the distribution of a printed description of the genus named; (2) in the publication of the name of the genus, and the citation of one or more previously published species as examples or types of the genus, with or without a diagnosis.

VI. Publication of Species.

Publication of a species consists only (1) in the distribution of a printed description of the species named; (2) in the publishing of a binomial, with reference to a previously published species as a type.

VII. Similar Generic Names.

Similar generic names are not to be rejected on account of slight differences, except in the spelling of the same word; for example, *Apios* and *Apium* are to be retained, but of *Epidendrum* and *Epidendron*, *Asterocarpus* and *Astrocarpus*, the latter is to be rejected.

VIII. Citation of Authorities.

In the case of a species which has been transferred from one genus, to another the original author must always be cited in parenthesis, followed by the author of the new binomial.

ZOOLOGY.

Fortuitous Variation.—In a paper just published, read before the Biological Society of Washington, on "Some Interrelations of Plants and Insects," in which Professor C. V. Riley deals with the subjects of Yucca pollination and fig caprification, he generalizes from the facts recorded as follows:

"The peculiarities which I have endeavored to present to you are full of suggestion, particularly for those who are in the habit of looking beyond the mere facts of observation in endeavors to find some rational explanation of them; who, in other words, see in everything they observe significances and harmonies not generally understood. The facts indicate clearly, it seems to me, how the peculiar structures of the female Pronuba have been evolved by gradual adaptation to the particular functions which we now find her performing. With the growing adaptation to Pronuba's help, the Yucca flower has lost, to a great extent, the activity of its septal glands; yet coincident with it we find an increase in the secreting power of the stigma. This increase of the stigmatic fluid has undoubtedly had much to do with originally attracting the moth thereto, while the pollenizing instinct doubtless became more and more fixed in proportion as the insect lost the power or desire of feeding. With the mind's eye I can look back into the past and picture the gradual steps by which the Prodoxids to which I have alluded have differentiated along lines which have resulted in

their present characteristics. On the one side I see variations which have become sufficiently fixed to be considered specific; yet which can have no especial bearing on the life necessities of the species, but are a consequence rather of that universal tendency to variation with which every student of Nature becomes profoundly impressed. Thus the wing-markings vary from a darker general coloring, as in *Prodoxus œnescens*, to a more uniform intermixture of the black scales among the white, as in *cinereus*, or a sparser intermixture thereof, as in *pulverulentus*. The disposition of the black scales is in spots or bands, whether transverse or longitudinal, as in *marginatus*, *reticulatus*, *Y-inversus*, etc. These are fortuitous variations, for I cancannot believe that the disposition of these marks where, as in these cases, they take every form that is conceivable, can be of any benefit to the species, any more than the mere variation in the number of lobes in the leaves of different oaks growing under like conditions can be of any particular benefit to the species, however useful to us in classification.

"In my address before the Section of Biology of the American Association for the Advancement of Science, at Cleveland, in 1888, I have discussed the various forms and causes of variation, and especially the limitations of natural selection, stating expressly that this last "deals only with variations useful to the organism in its struggle for existence, and can exert no power in fixing the endless number of what, from present knowledge, we are obliged to consider fortuitous characters," and I have long recognized, from my studies of insect life, the existence of these fortuitous variations. The subject has since been very well elaborated by Professor Ward in his communication to the Society (December 15, 1888) on "Fortuitous variation as illustrated by the genus Eupatorium" and in his Annual Address (January 24, 1891) on "Neo-Darwinism and Neo-Lamarckism," and the Prodoxidæ furnish an excellent illustration of this fortuitous variation. Yet at the same time that we note this chance variation, as exemplified in a number of the species of Prodoxus, which are mere ravagers or despoilers and have not been brought into any special or mutual relations with the plant, we have, on the other hand, in *Pronuba yuccasella*, correlated with the other striking structural modifications which have brought it into such special relations with the plant, an elimination of all maculation or markings upon the primaries, and a purely white coloring so fixed that it shows absolutely no variation over half the continent. The structural variation has been necessary—a consequence of effort, environment,

and natural selection. The color variation, on the contrary, has not been absolutely necessary, yet has nevertheless gone on in lines which, tending to give greater protective resemblance to the flower, have in the long run proved to be, perhaps, the most advantageous. I thus recognize three distinct lines of variation as exemplified in these Prodoxidæ, and what is true of them is, I believe, true of all alliances of organisms. The first and most important is structural and generic; it is absolutely essential and is preserved in its perfection by the elimination, through natural selection, of all forms departing from it. The second is merely coincident, not essential, but nevertheless along lines that are of secondary advantage. The third is purely fortuitous, affects superficial features in the main, is unessential (a consequence of the inherent tendency of all things to vary), and takes place along all lines and in all directions where there is no counteracting resistance."

Structure of Calcareous Sponges.—Minchin[1] finds in a calcareous sponge, which he identifies as *Leucosolenia coriacea*, a peculiar fenestrated membrane crossing the oscular openings. This "sieve membrane" is composed of two layers of cells and crosses the tube just above the limits of the flagellate entoderm. Minchin, with a question, identifies the two layers as ectoderm and entoderm, and thus is it probable that the membrane is formed by the gastral cavity breaking through to the exterior at several points during development. Interesting comparisons are made with the sieve plates of several Hexactinellids. In a second paper[2] the same author concludes from a study of Naples material that *L. clathrus* does not have the oscula permanently closed, but that these openings are capable of occlusion by means of a sphincter of ectoderm. Further that Haeckel's so-called species, *Ascetta labyrinthus*, *A. mœandrina*, *A. clathrina* and *A. mirabilis* are all different stages of contraction of the one species, *Leucosolenia clathrus*.

On Echinorhynchus.—Two extensive works on the embryology of *Echinorhynchus* have recently appeared in Germany, one by Kaiser, which is not yet completed, the other by Hamann.

The following is a brief summary of Hamann's article. (Die Nemathelminthen, Jena, 1891, 119 pages, 10 plates.)

The first stages can be studied to the best advantage on *E. acus*. The extrusion of the pole-bodies and the division into 2 and 4 cells

[1] Q. J. M. S., xxxiii, 251, 1891.

[2] *l. c.*, p. 490, 1892.

occur while the egg is still in the "egg-ball." It is not yet determined at what time the fertilization of the ovum takes place. In the case of *E. acus* the gastrula (larva with 6–8 hooks) goes through certain changes, in the body of the mother, which in other species are delayed until the parasite arrives in an intermediate host. According to Hamann the nuclei of the ectoblast unite to form very large nuclei, the ectoblast being a syncytium.

Ectoderm:—A syncytium with large nuclear bodies which are amoeboid and give rise by *direct division* to the nuclei of the skin; the fibres in the skin are looked upon as elastic. The species *E. clavæceps* is especially interesting: in this case the skin of the adult remains a syncytium with large nuclear bodies; author looks upon this as a case of paedogenesis. In other species the ectoderm separates into two layers: an outer layer with nuclei and elastic fibres, an inner layer in which the lacunes are formed. The lacunes of the skin and lemnisci form at the same time that the giant nuclei of the ectoderm divide into the skin-nuclei. The lemnisci arise as two lateral papillæ of ectodermal origin; these project into the body cavity; they are at first solid but when they have reached their full length a number of light colored spots became visible in their substance; these spots grow more numerous, become connected and form the canal-system. In *E. clavæceps* the lemnisci retain their larval character, being round with central canal and two very large nuclei. In other species the lemnisci are more highly developed; the canal-system is branched and numerous nuclei are present. The canal-system of the lemnisci, neck and rostellum unite in the circular canal and, according to Hamann (in agreement with Schneider but in opposition to Leuckart's view), are entirely separated from the lacunes of the rest of the body. The lemnisci are compared with the ampullæ of the echinoderms. Hamann supposes them to aid in stretching the rostellum and to act as a reservoir for the liquid when the rostellum is retracted.

Entoderm:—In the early stages the entoderm is a solid mass, but as the parasite develops, an outer layer of cells separates from the central mass and forms an epithelial lining membrane for the body-cavity (coelom); the remaining cells give rise to the genital organs and the ligament. On the outer layer peripheral circular muscle fibrillæ form in each cell, thus giving rise to epithelial-muscle cells of entodermal origin. Some of these cells leave their position in the epithelium and wander to its median surface where they assume a spindle shape and give rise to the longitudinal muscles, which anastomose.

The anlage of the proboscis forms very early; two cells differentiate at one pole of the entoderm, behind this the cells gradually coalesce. The sheath is also entodermal. The proboscis is formed *invaginated* inside the sheath; the cause of exvagination is to be sought for in the growth of the animal in length. (Reviewer does not understand author's argument in this case.) Before exvagination the rostellum is solid; what becomes of the centre core is somewhat uncertain. The hooks are also of entodermal origin; further, the nervous system, which arises at about the same time with the rostellum, and consists of a double ganglion at the base of the rostellum, two lateral and one median anterior nerves and two lateral posterior nerves. The latter connect with a double ganglion on the bursa of the male. The ganglion cells were uni-polar.

Hamann's results differ very greatly, in some particulars, from those arrived at by Kaiser. Kaiser's magnificent monograph will be reviewed in a later issue of THE NATURALIST.—C. W. S.

Onchnesoma.—Shipley has recently studied[3] the anatomy of *Onchnesoma steenstrupii*, the smallest species of this boreal genus of Sipunculids. In correspondence with its small size (length 3 mm.) it is much simplified. It has no tentacles, no vascular system, a single retractor muscle, a single nephridium, and a not-bilobed brain. On account of the lack of tentacles this Sipunculid, at least, does not breathe by these organs, and Shipley is inclined to regard the intestine as the chief respiratory organ here. He is farther inclined to think that the chief function of the tentacles, when present, is to create currents bringing food to the mouth, and that the chief use of the vascular system is to extend the tentacles.

The Hæmal Region of Echinoderms.—This portion of the echinoderm structure has always been a terra incognita. In the course of an interesting article on "Wandering Cells in Echinoderms"[4] (dealing with the processes of excretion throughout the animal kingdom) Mr. H. E. Durham says: "The following method of regarding the relations of the water tube, dorsal organ, axial perihæmal sinus, and the madeporic or water pores has, I believe, never been formulated; it has the advantage of bringing the different arrangements which have been described into harmony, and will put an end to the battles which have been fought over the point. First of all we must

[3]Quarterly Jour. Micros. Sci., xxxiii, p. 233, 1892.

[4]Quarterly Jour. Micros. Sci., xxxiii, 81, 1892.

refer to Bury's discovery that the central water vascular apparatus is developed in three pieces; (1) the water tube, (2) an ampulla of an anterior enterocœle, (3) the water pore. He further promises to prove that the left anterior enterocœle becomes the so-called slauchformiger canal, here called the axial perihæmal sinus. In specimens of Cribrella 2 mm. in diameter, I find that there is as yet but a single water pore, which communicates with the cavity of axial sinus; into the latter the free end of the water-tube opens; thus these three spaces are in communication with one another at a comparatively early period. Now this free communication may remain throughout life in many forms, as Cuénot proves, and as I showed in *Cribrella oculata.*

Now the cavity of the axial sinus extends amongst the strands which form the dorsal organ; these spaces we will term intercanicular as distinguished from the intracanicular which are the actual cavities of the strands themselves, and between them there is no free communication, as has already been stated.

In the dorsal organ of echinids there exist epithelium-lined cavities which communicate together, and with a cavity extending longitudinally along the organ; this is termed the canal aquifére annexe by Prouho, and the spaces Kanäle zum Wassergefäss gehörend by Hamann in *Spatangus purpureus.*

Into this space or system of spaces there is free communication on the one hand, with the water tube, and on the other with the madreporic pores, but this only occurs in certain forms (Spatangus, Dorocidaris). Hamann denies that there is any such communication in the regular echinids he investigated; this space, therefore, bears exactly the same position in these echinids that the axial (perihæmal) sinus holds in the asterid; in fact, the one is the homologue of the other. The presence or absence of free communication with the water and madreporic tubes depends on whether the embryonic developmental condition has been retained or lost. There is some difference in the arrangement of the axial sinus in the asterid and echinid, for whereas in the former the sinus contains the dorsal organ, in the latter it is nearly surrounded by the tissue of that organ; that is, in the former the wall of the sinus has only given origin to hæmal strand tissue along our line, whilst in the latter this tissue has been developed from all parts of the wall except a narrow strip on either side of the water tube. If we imagined the wall of the axial sinus of an asterid to contract upon the contained organ, and ultimately to come in contact and fuse with its surface, except along the stone canal, we should obtain a condition closely resembling that described by Prouho in

Dorocidaris; some alteration would have to be made in the structure of the dorsal organ at the same time, for it does not consist as definitely of a number of anastomosing tubular structures as it does in the asterid. Furthermore, we may predict that if, as Bury shows, that in asterids the axial sinus is derived from the left anterior enterocœle, careful investigation will show that the canal aquifére annexe, or axial sinus of echinids, is similar in its development.

In ophiurioids an axial (perihæmal) sinus exists, but according to Hamann it does not communicate with the water vascular apparatus in the adult.

This view seems to me to reconcile the discrepancies in the descriptions which have been published of the anatomy of the region, the differences having apparently arisen from the retention or loss of the embryonic condition of the individual examined.

Wild Animals and Snakes in India.—In the report on the Administration of the Bombay Presidency for the year 1890–91 is to be found the following interesting account of "The destruction of wild animals and venomous snakes": The whole number of people killed by wild animals and snakes within the Presidency, including Scind, during the year 1890, was 1122 as compared with 1160 in the previous year. The number of deaths caused by tigers and leopards was twenty only, of which sixteen occurred in the Khandesh District. In the previous year forty-seven persons were thus killed in that District. In the Broach District seven persons were killed by wolves and three by other animals. The mortality from snake-bite was slightly lower than in the previous year. The most deaths from this cause occurred in Scind, there being 497; the fewest in the Central Division, but 105. In the Northern and Southern Divisions there were 241 and 232 respectively. The number of wild cattle killed by beasts of prey and snakes decreased from 2188 in 1889 to 1883 in 1890. In Kanara, however, the number of cattle killed in 1890 was 938, exceeding the record for the past ten years. The total number of wild animals destroyed during the year was 836, and of snakes 406,092; this was 27,703 fewer snakes than in 1889. The total amount paid as rewards for the destruction of wild animals and snakes during the year was 12,655 rupees, 13 annas and 2 pice (about $5,695.15). (Forest and Stream, April 14, 1892.)

The Phylogeny of the Apteryx.—Prof. T. J. Parker concludes his memoir on the anatomy and development of the Apteryx[5] with the

[5]Phil. Trans., Vol. cclxxxii, 1892.

following summary of the characters supporting the view that Apteryx has been derived from a flying bird: The presence of an alar membrane or patagium; of pterylæ and apteria; of remiges and tetrices majores; the attitude assumed during sleep; the presence of two articular facets on the head of the quadrate; of a pygostyle; of vestigial acromial, procoracoid and acrocoracoid processes; the extreme variability of the sternum, shoulder girdle and wing, indicating degeneration; the occasional occurrence of a median longitudinal ridge or vestigial keel on the sternum; the position of the shoulder girdle and sternum in Stage E; the fact that the skeleton of the fore limb is that of a true wing in Stage F; the early assumption of undoubted avian characters in the pelvis; the typically avian characters, both as to structure and development, of the vertebral column and hind limb; the fact that the brain passes through a typical avian stage with lateral optic lobes; and the relations of the subclavius muscle.

On the other hand the total absence of rectrices tells against this view.

The following characters indicate descent from a more generalized type than existing birds. The characters of the chondrocranium, especially in the earlier stages, but many of these peculiarities, *e. g.*, the absence of interorbital septum, may, however, be correlated with the diminished eyes and the enlarged olfactory organs; the presence of an operculum in early stages (as this structure has not been described in reptiles, it either proves nothing or too much); the presence of a well marked procoracoid in comparatively late embryonic life; and the characters of the pelvis.

Again, the early assumption of their permanent position by the limbs; the late appearance and obviously degraded character of the hyoid portion of the tongue bone; the position of the nostrils and the peculiar mode of development of the respiratory portion of the nasal chamber and the total absence of clavicles are characters in which the Apteryx exhibits greater specialization than other birds.

The general balance of evidence seems to point to the derivation of both Ratitæ and Carinatæ from an early group of typical flying birds or Protocarinatæ.

It has always seemed to me that on the hypothesis of its development from an ordinary reptilian fore limb, *e. g.*, that of a Dinosaur, the wing is one of the most striking examples of the uselessness of incipient structures. If, on the other hand, we suppose it to have been evolved from a patagium which gradually diminished *pari passu* with

the development of its scales into feathers, the difficulty of its first origin is overcome and the presence of the alar membranes is explained.

Ridgway on the Anatomy of Humming-birds and Swifts.—Ornithological literature has very recently been enriched by a monograph upon the Humming-birds, from the pen of Mr. Robt. Ridgway of the U. S. National Museum. It comes to me in the form of a reprint from the Report of that institution for 1890, and is now just issued. As valuable as may be the descriptive part of the contribution, I find it impossible for me to overlook certain very glaring errors our author has fallen into, in regard to the anatomy of the birds he treats. Ridgway still adheres to that now well-nigh exploded notion that the Humming-birds are more or less closely related to the Swifts, and he says "The Humming-birds and Swifts further agree in numerous anatomical characters, and there can be no doubt that they are more closely related to each other than are either to any other group of birds." In setting forth some of the anatomical characters he claims to find in the Humming-birds, in support of this theory, he remarks in regards to the structure of the tongue that "it is hollow and divided at the tip into two slender branches * * * * *." Now the tongue in the Humming-birds is *not hollow*, and I would kindly invite Mr. Ridgway's attention to the very careful dissections of that organ made by the Scotch anatomist W. MacGillivray, and published in the 4th volume of Audubon's Birds of America, and also the results of my own extensive dissections which appeared in *Forest and Stream*, July 14, 1887 (p. 581).

Again our author states that "except in the shape of the bill and structure of the bones of the face, the Humming-birds and Swifts present no definite differences of osteological structure." (p. 290). This statement is not only not true, but as wide of the mark as it well can be, and the wonder to me is, how such a cautious and candid writer as Mr. Ridgway has always proved himself to be, could have allowed his pen to record such an error. As a matter of fact, when we come to compare the skeleton of a typical Swift with that of a typical Humming-bird we find the most radical differences existing in nearly every part, that one can well imagine. As Huxley and a number of other capable anatomists have long ago shown, the skull and associate skeletal parts of a Swift depart not very markedly from the corresponding structures in a Swallow, while they very decidedly differ from the same parts as we find them in a humming-bird. These differences are to be seen in nearly all the rest of the skeleton, when

we come to compare the characters presented on the part of the various bones in a typical Swift, a typical Swallow and a Hummingbird. Not only is this true but the same departures and agreements are to be found in other and quite as important systems of the economies of the several forms mentioned, as in the osseous system. It is several years ago now since I called attention to these facts, but they are very fully set forth in a number of papers of mine which have appeared from time to time in the P. Z. S.; in the Journal of the Linnean Society of London; in *Forest and Stream* and elsewhere.—Dr. R. W. Shufeldt, Takoma, D. C., July 26, 1892.

Zoological News.—Protozoa.—Schütt describes[6] for almost the first time the protoplasmic body of the Peridiniidæ. The richness of the vacuolution is interesting but is not easily described without illustration.

Greef continues[7] his description of the earth Amoebæ. After an account of the general morphology of the group follows a description of the species, of which two are new.

Vertebrata.—A. H. Church has re-studied the peculiar pigment turacin found in the birds of the family Musophagidæ. He finds[8] that eighteen out of the twenty-five species of the family constantly possess this copper containing pigment and that these eighteen species embrace all the members of the genera Turacus, Gallirex and Musophaga, while the other genera of plantain eaters lack it. The analysis of turacin proved very difficult. The best results seem to show the existence of 7% of copper.

Waldeyer describes[9] with some detail the histology of the stomach and intestine of *Manatus americanus*.

F. E. Schulze says[10] that with Golgi's chrom-osmic-silver method one can readily trace free nerve ends in the epidermis of the lip of the fish Cobitis fossilis. In sections one can occasionally trace the deep black nerve fibres clear to the epidermal surface, where they end either abruptly truncate or with a small end knot (knötchen).

[6]Stz. k. Akad. Berlin, 1892, p. 377.

[7]Stz. Gesell. Naturwiss, Marburg, 1891, p. 1 (1892).

[8]Proc. Roy. Soc., li, 399, 1892.

[9]Stz. k. Preus. Akad. Wiss., Berlin, 1892, p. 79.

[10]Stz. k. Preus. Akad., Berlin, 1892, p. 87.

ENTOMOLOGY.

Habits of Prenolepis imparis Say.—**The Winter Ant.**—This ant rarely appears outside of its nest during the heat of the day, from 12 to 4 o'clock (although an occasional individual comes out in the middle of the day), while the little brown Lasius and black Formica are active at that time. It is one of the commonest ants in the Northern States, and is among the earliest to appear in the spring, occasionally appearing during mild winters, but becomes less active in summer, avoiding the heat.

The males and females take their marriage flight in April, as Say has recorded and as I have many times observed, the latest date at which I have found the winged female being May 9. It seems probable, therefore, that the males and females must pass the winter as pupæ or very advanced larvæ, although in nearly all our other ants they hibernate in a much earlier stage and the mature forms do not appear until much later in the season.

This ant bears much resemblance to some species of Lasius, but may at once be distinguished by the absence of a discoidal cell in the wings and the different form of the petiole of the abdomen. The genus Prenolepis resembles Tapinoma in having the scale of the petiole in the worker nearly concealed by the base of the abdomen, but the male and female may be distinguished by having no discoidal cell. The male and female of this species were described by Say under the old genus Formica and it has not since been identified. Roger in his "*Verzeichniss*" has queried whether it might not be a Lasius; it is, however, identical with the European type of Prenolepis, *P. nitens* Mayr, which its author has already recorded from North America. Roger, in 1859, described the female, and in 1862 the worker from European specimens under the name *Formica crepusculascens*, but at the latter date recognized the synonomy with *P. nitens*.

Tapinoma polita, described by Smith from a single worker found in Wales, has been placed by Roger as a synonym of *P. nitens*, but apparently in error, as Smith compared his species with *nitens* and pointed out differences in the antennæ, the scale, and the color of abdomen, which appear to be at least of specific value. *T. polita* was omitted in Mayr's *Index*. Mayr, in "Europ. Form," p. 52, note, considers *polita* a synonym of *nitens*. The synonymy is then :

PRENOLEPIS IMPARIS (Say).—*Formica imparis* Say, [? *Lasius*] Roger, Verzeichniss; *Prenolepis nitens* Mayr: *Prenolepis nitens* Roger; ♀ ☿ (1852), (Nec. *Tapinoma polita* Smith., see Roger and Mayr); *Formica crepusculascens* Roger, ♀ (1859).—WM. HAMPTON PATTON.

Description of the Female of Aphænogaster fulva Roger.—I have found the winged females of *Aphænogaster fulva* in the nest on the 15th of July and flying on July 17. This sex, hitherto undescribed, is closely like the worker, but is larger (length six to seven millimeters), and the metathoracic spines are blunt. The wings are hyaline, the stigma and nervures yellow: there is sometimes present *a second recurrent* vein (received by the second submarginal cell), and in one specimen before me there is a stub of a vein projecting into the first submarginal cell from the second submarginal cell.

WM. HAMPTON PATTON.

Spread of the Horn Fly.—This insect (*Hæmatobia serrata*), which apparently was introduced into the United States from Southern France in 1887, having been first noticed in New Jersey that year, has rapidly spread west, north and south. In a recent issue of the "Southern Live Stock Journal" Mr. H. E. Weed says it is now common in most of the Southern States east of the Mississippi River. It is abundant in Ohio, and has lately been migrating northward in New England. I recently visited a locality (Hartland) in Vermont, a few miles south of Hanover, N. H., where the insect is abundant and is causing considerable annoyance to dairymen. Spraying affected cattle with kerosene emulsion is proving the most practicable remedy.—C. M. W.

Chinch Bugs in New Hampshire.—The chinch bug (*Blissus leucopterus*) has been reported a number of times from New England. In Massachusetts specimens have been collected at Cambridge by Drs. Harris and Dimmock, and at Salem by Dr. Packard. In Maine they have been collected by Prof. H. L. Fernald and Dr. Packard. The latter has also taken specimens at the summit of Mt. Washington in New Hampshire. The present season I have taken three specimens of this species at Hanover, N. H. Two of the short-winged form were taken April 23, under boards along a pasture fence, and one of the normal long-winged form was swept from grass early in June. These were the only specimens that occurred during the season's persistent collecting.—C. M. W.

Instinct of Ammophila affinis.—Dr. P. Marchal has made[1] many observations on the well-known habits of this sand-wasp, which, like other Sphegidæ, paralyzes its victims by stinging the ventral ganglia. He concludes that the habit is not wholly disinterested; that there are many gradations between the insect which kills and that which paralyzes its victims; that the procedure is by no means stereotyped, but variable in details; that the stinging of the ganglia is not necessary to secure paralysis, indeed the sting must, from the nature of the victim, be often effected between the ganglia. None the less, Dr. Marchal admits the wonder of the instinct, and suggests, as Mr. Darwin also did, how the inefficacy of stinging the sides of the victim might lead to the habit of stinging the median ventral line, and eventually the ganglia. Moreover, the median ventral line is often the most convenient and natural line of attack.—*Journal Royal Microscopical Society.*

Some Florida Spiders.—The following species of spiders were collected by me at Inverness, Citrus Co., Fla., during January and February, 1892:

Agalena nævia Bosc.
Lathrodectes mactans Koch.
Gasteracantha cancer Hentz.
Nephila plumipes Koch.
Phidippus miniatus Peck.
Marptusa familiaris Hentz.
Lycosa, a large species.

I am indebted to the kindness of Mr. Nathan Banks for the determinations.—CLARENCE M. WEED.

Recent Entomological Publications.—Prof. F. H. Hillman issues as Bulletin No. 17 of the Nevada Experiment Station a popular discussion of the woolly aphis of the apple (*Schizoneura lanigera*). "The extreme dry weather of the past spring and early summer has been very favorable for the development and longevity of the aphids, and as the result they are to be found in immense numbers. Those trees surrounded by shrubbery and frequently irrigated apparently are affected less than the others."

Prof. S. W. Williston has lately published[2] the second part of his "Diptera Braziliana." Eight new species of Conops are described.

[1]Arch. Zool. Expér. et. Gen., x, 1892, pp. 23-36.

[2]Kansas University Quarterly, i.

In the same publication Mr. W. A. Snow publishes notes on a collection of Syrphidæ made in Colorado by Prof. F. H. Snow, including descriptions of a number of new species; and Prof. V. L. Kellogg prints some interesting notes on *Melitera dentata* Grote, the larvæ of which eat the soft inner tissue of the prickly pear cactus (*Opuntia missuriensis*).

Two discussions of the insects affecting stored grain have lately appeared. The first, by Mr. H. E. Weed, forms Bulletin No. 17 of the Mississippi Experiment Station, and the second, by Prof. E. W. Doran, forms Bulletin No. 16 of the Maryland Station.

Dr. J. B. Smith continues his contributions to a monograph of the Noctuidæ of Boreal America.[3] In the last instalment he revises the species of the Dicopinæ, and of the genera Cucullia, Xylomiges and Morrisonia.

Mr. H. E. Weed has lately prepared[4] a useful account of the insects affecting cabbage in the Southern States. The article is well illustrated, several of the figures being new.

Dr. C. V. Riley publishes in "Insect Life" (iv, pp. 358–378), a very interesting paper read before the Biological Society of Washington on Some Inter-relations of Plants and Insects. The pollination of Yucca, and the caprification of the fig are chiefly discussed.

Mr. Wm. Beutenmüller publishes[5] four articles concerning Lepidoptera. In two of them notes made by the late Henry Edwards and S. Lowell Elliot are incorporated.

Entomology at Rochester.—The Rochester meeting of the A. A. A. S. was one of unusual interest to entomologists, both from the number present and the interest shown in the papers presented. Most of the entomological papers were presented before the Association of Economic Entomologists and the Entomological Club, while a few of especial interest were presented before the Society for the Promotion of Agricultural Science and Section F of the general Association.

The following papers were presented before the Association of Economic Entomologists, which held its meetings two days before the A. A. A. S.:

[3]Proc. U. S. Nat. Mus., xv, pp. 33–86.

[4]Miss. Expt. Station, Bulletin No. 21.

[5]Bull. Am. Mus. Nat. Hist., iv, No. 1.

Address of President.—Owing to the ill-health of President Lintner, the First Vice-President, Mr. S. A. Forbes, presented the address, which consisted in a review of the more important economic literature of the year, together with a report of the progress being made with bacterial diseases as related to economic entomology.

Notes on *Hypoderus columbæ*, by D. S. Kellicott, noting the finding of this species while dissecting pigeons at the Ohio State University. This is the first record of the appearance of the species in this country.

Additional Notes of Ægeriidæ of Central Ohio, by D. S. Kellicott, giving further details of some of the species of this family not heretofore recorded in Mr. Kellicott's papers.

Two Serious Pear Pests, by M. V. Slingerland, describing the damage done in New York by the pear tree Psylla (*P. pyricola*) and the blister mite (*Phytopterus pyri*).

An Experiment Against Mosquitoes, by L. O. Howard, describing in detail an experiment undertaken to test the recommendation of the application of kerosene to the surface of small pools and stagnant water. Mr. Howard reported marked success with this remedy, and had no doubt but that if used properly many places which now swarm with this pest would be almost entirely free. Owing to the nature of the remedy it probably could not be used upon a large scale with success, but upon small ponds of stagnant water it would be very useful.

Notes on the Bean Weevil (*Bruchus obsoletus*) and *Drasteria erechta*, by M. V. Slingerland, giving the life history and manner of work of these species.

An Enemy of Timothy Grass, by L. O. Howard, describing the work of a homopterous species which had been noticed this season in Green County, New York.

Orthesia insignis as a Garden Pest, by T. D. A. Cockerell, was read by the Secretary, describing the work of this species in Jamaica.

Some Features of Joint Worm Attack, by F. M. Webster, an interesting paper showing the peculiarities of attack and an exhibit of specimens.

Food Habits of N. A. Membracidæ, by F. W. Goding, was read by the Secretary, giving a list of the food plants of the species of this family.

Notes of the Year in New Jersey, by J. B. Smith, giving mention of the principal species doing damage the present year, especially the rose chafer.

Notes from the Mississippi Station, by Howard Evarts Weed, giving account of new injurious species and other notes. Especial attention

was called to the horn-fly and the fact brought out that this species is found most upon dark-colored animals, those of a light color being almost entirely free.

Notes on the Parsnip Web-worm (*Deprassaria heracliana*), by E. B. Southwick, an account of the damage and abundance of this species in New York.

Notes of the Year in Canada, by James Fletcher, root maggots and thrips being especially abundant, while cut-worms are not as abundant as usual.

An Australian Scymnus, by C. V. Riley, a species recently described from the Western States, which is an introduced Australian species.

Further Notes on Mollusks, by F. M. Webster, showing the relation of slugs to Aphides.

Officers elected: President, S. A. Forbes; First Vice-President, C. J. S. Bethune; Second Vice-President, J. B. Smith; Secretary, H. Garman.

The Entomological Club of the A. A. A. S. held its meetings during the general meetings of the Association at such times as did not interfere with the Section of Biology. President Schwartz presided. The Secretary, Mr. Marlatt, being unable to be present, Howard Evarts Weed was elected Secretary for the meeting. The following papers were presented:

President's Address by E. A. Schwarz, consisting of a review of the progress made in Coleoptera in recent years and the particular fields of research yet open in this line.

Insects Reared from Gall on *Muhlenbergia mexicana*, by F. M. Webster, giving an account of the species reared, over twelve in number.

A Cutaneous Disease of Cattle Caused by an Arachnoid, by C. W. Stiles, the disease being caused by a species of *Demodex*.

Galeruca xanthomelæna Polygoneutic at Washington, by C. V. Riley, showing that this species was normally two, and, at times three, brooded at Washington.

Galeruca xanthomelæna Monogoneutic at New Brunswick, N. J., by J. B. Smith, showing that the species is normally but single brooded at New Brunswick. In the discussion which these papers brought forth it was thought that the difference in habit between the species at Washington and New Brunswick was not so much in the difference in climatic conditions, as it was in acquired habits. Mr. Riley thought that specimens sent to New Brunswick from Washington would

remain double brooded, while those sent to Washington from New Brunswick would there be single brooded.

The Inhabitants of a Fungus, by H. G. Hubbard, giving a list and account of many species found breeding in a fungus.

Mr. Webster introduced Dr. Edward Murphy of New Harmony, Ind., who gave an interesting account of the life of Thomas Say. Dr. Murphy was personally acquainted with Say for many years before the latter's death.

Notes on a Trip to Nipigon, by James Fletcher, giving an account of the principal species found in this region.

The Arthropoda of Liberia, by O. F. Cook, giving notes of the principal forms noticed there from December to June.

Honey Bee or House Fly, by Herbert Osborn thought that the arrangement of orders as to descent was not natural, but that the orders should be considered as on a level.

Life-History of *Gryllotalpa borealis*, by E. W. Doran, giving detailed descriptions of the different stages of growth.

The Osage Orange Pyralid, by Mary E. Murtfeldt, an account of the damage by a new species upon the Osage Orange.

A Borer in the Stem of the Red Current, by E. W. Claypole, an account of the damage done by *Janus flaviventris*.

The Insect Fauna of the Mississippi Bottoms, by Howard Evarts Weed, giving an account of the principal species collected in the bottom lands along the Mississippi river.

Do Termites Cultivate Fungi? by O. F. Cook, an account of observations in Liberia.

The Committee appointed at the Washington meeting to report upon the advisability of the preparation of a manual of Entomology, made a report of progress and was continued until another year.

The Committee on Entomological Congress in 1893 recommended that the officers of the Club be instructed to call an International meeting of Entomologists at the time and place of the meeting of the Club in 1893. The report was adopted.

Officers elected: President, C. J. S. Bethune; Vice-President, H. G. Hubbard; Secretary, C. L. Marlatt.

Before the Society for the Promotion of Agricultural Science the following were presented.

The Harlequin Cabbage-Bug, by Howard Evarts Weed, an account of the distribution and damage by this species and calling attention to a new and very effective remedy—that of planting a row of mustard through the center of a cabbage field.

The Destruction of Leaf Hoppers, by Herbert Osborn, an account of an experiment with the "hopper dozers" for grass insects.

Several papers of Entomological interest were presented before the Section of Biology, which are mentioned in our report of its proceedings.

As the biological section of the Association was divided into two sections, Botanical and Zoological, no doubt hereafter many papers which have heretofore been presented before the Entomological Club will be presented before the Zoological section.—HOWARD EVARTS WEED, *Agricultural College, Mississippi.*

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

American Association for the Advancement of Science.—The forty-first meeting of this body was held at Rochester, N. Y., in the University Building, commencing Wednesday, August 17, and adjourning Tuesday, August 23. The officers of the meeting were as follows: President, Joseph LeConte, Berkeley, California. Vice-Presidents—A. Mathematics and Astronomy, J. R. Eastman, Washington, D. C.; B. Physics, B. F. Thomas, Columbus, Ohio; C. Chemistry, Alfred Springer, Cincinnati, Ohio; D. Mechanical Science and Engineering, John B. Johnson, St. Louis, Mo.; E. Geology and Geography, H. S. Williams, Ithaca, N. Y.; F. Biology, S. H. Gage, Ithaca, N. Y.; H. Anthropology, W. H. Holmes, Washington, D. C.; I. Economic Science and Statistics, Lester F. Ward, Washington, D. C. Permanent Secretary, F. W. Putnam, Cambridge (office Salem), Mass. General Secretary, Amos. W. Butler, Brookville, Ind. Secretary of the Council, T. H. Norton, Cincinnati, Ohio. Secretaries of the Sections.—A. Mathematics and Astronomy, Winslow Upton, Providence, R. I.; B. Physics, Brown Ayres, New Orleans, La.; C. Chemistry, Jas. Lewis Howe, Louisville, Ky.; D. Mechanical Science and Engineering, Olin H. Landreth, Nashville, Tenn.; E. Geology and Geography, R. D. Salisbury, Madison, Wis.; F. Biology, Byron D. Halstead, New Brunswick, N. J.; H. Anthropology, W. M. Beauchamp, Baldwinsville, N. Y.; I. Economic Science and Statistics, Henry Farquhar, Washington, D. C. Treasurer, William Lilly, Mauch Chunk, Pa.

In the afternoon of Wednesday, August 17, Prof. H. S. Williams, Chairman of the Geological Section, delivered an address on the Scope of Paleontology and its Value to Geologists. In the Biological Section Chairman Prof. S. H. Gage delivered the address on Respiration. The address of Mr. W. H. Holmes was, On the Evolution of the Aesthetic.

Section E, *Geology and Geography.*—Thursday, August 18.—The following papers were read: Terminal Moraines in New England, by C. H. Hitchcock; A Passage in the History of the Cuyahoga River, by E. W. Claypole; Notes Bearing Upon the Changes of the Preglacial Drainage of Western Illinois and Eastern Iowa, by Frank Leverett; Extra-morainic Drift in New Jersey, by A. A. Wright;

The Volcanic Craters of the United States, by Rob't T. Hill; Recent Geological Explorations in Mexico, by Rob't T. Hill; Presentation of Samples from Salt Mines of New York, by S. A. Lattimore.

Friday, August 19.—Paleobotany of the Yellow Gravel at Bridgeton, N. J., Arthur Hollick; The Mining, Metallurgical, Geological, and Mineralogical Exhibits to be Shown at the World's Columbian Exposition, Geo. F. Kunz; Cerro-Viejo and Its Cones of Volcanic Ejecta and Extrusion in Nicaragua, John Crawford; Pleistocene Geography, W. J. McGee; Submarine Valleys on Continental Slopes, Warren Upham; The Homotaxic Relations of the North American Lower Cretaceous, Robt. T. Hill.

Monday, August 22.—Distributions of the Lafayette Formation, W. J. McGee; Cenozoic Beds of the Staked Plains of Texas, E. D. Cope; Exhibitions of Guelph Fossils Found in Rochester, N. Y., Albert L. Arey; The American Mastodon in Florida, John Kost; Some Problems of the Mesabi Iron Ore, N. H. Winchell; The Mathematics of Mountain Sculpture, Verplank Colvin; A New Genus of Marsupialia from the Laramie, E. D. Cope.

Section F, *Biology.*—It was decided that hereafter the Biological Section shall be divided into two, those of Zoology and Botany.

Thursday, Aug. 18.—Notes on Ranunculus repens and its Eastern North American Allies, by N. L. Britton; Notes on a Monograph of the North American Species of Lespedeza, by N. L. Bitton; Contribution on the Digestive Tract of Some North American Ganoids, by G. S. Hopkins; The Root System of Mikania scandens L., by W. W. Rowlee; The "Maxillary Tentacles" of Pronuba, by J. B. Smith; Preliminary Comparison of the Hepatic Flora of Boreal and Sub-boreal Regions, by L. M. Underwood; On the Value of Wood Ashes in the Treatment of Peach Yellows, by E. F. Smith; On the Value of Superphosphates and Muriate of Potash in the Treatment of Peach Yellows, by E. F. Smith; Spikes of Wheat Bearing Abnormal Spikelets, by W. J. Beal; A Study of the Relative Lengths of the Sheaths and Internodes of Grasses for the Purpose of Determining to What Extent This is a Reliable Specific Character, by W. J. Beal; Adaptation of Seeds to Facilitate Germination, by W. W. Rowlee; Report of Biological Section of the Committee on the Naples Table, by C. W. Stiles; Bacteriological Investigations of Marine Waters and the Sea Floor, by H. L. Russel.

Friday, August 19.—Notes on Maize, G. Macloskie; Sketch of the Flora of Death Valley, California, F. V. Coville; How

the Application of Hot Water to Seed Increases the Yield, J. C. Arthur; Heredity of Acquired Characters, by M. Miles; The Production of Immunity in Guinea Pigs from Hog Cholera by the Use of Blood Serum from Immunized Animals, E. A. deSchweinitz; On the Supposed Correlation of Quality in Fruits—A Study in Evolution, L. H. Bailey; The Descent of the Lepidoptera.—An Application of the Theory of Natural Selection to Taxonomy, J. H. Comstock; Non-parasitic Bacteria in Vegetable Tissue, H. L. Russell; Notes on Yellow Pitch-pine, Pinus rigida Mill. var. lutea Kell. n. v., W. A. Kellerman; Germination at Intervals of Seed Treated with Fungicides, W. A. Kellerman; The Fertilization of Pear Flowers, M. B. Waite.

Monday, August 22.—On the Adult Cestodes of Cattle and Sheep, C. W. Stiles; The Fertilization of the Fig and Caprification, C. V. Riley; An Interesting Case of Parasitism, A. H. Tuttle; A Comparative Study of the Roots of Ranunculaceæ, F. B. Maxwell, presented by W.R. Dudley; Do Termites Cultivate Fungi? O. F. Cook; Note on the Appearance of Two Embryo Chicks in an Single Blastoderm, R. O. Moody; The Proposed Columbus Biological Stations in Jamaica, A. H. Tuttle; Adaptation of Plants to External Environment, W. P. Wilson; Notes on Self-pollination of the Grape, S. A. Beach; The Comparative Influence of Odor and Color in Attracting insects, G. B Sudworth; A Preliminary Account of the Brain of Diemyctylus viridescens based upon sections made through the entire Head, S. P. Gage.

Tuesday, August 23.—Notes on some Fresh Water Mollusks, W. M. Beauchamp; The Conditions which Determine the Distribution of Bacteria in the Water of Rivers, J. H. Stoller; Biological Notes on Fauna of Cold Spring Harbor, C. W. Hargitt; Geographic Relationship of the Flora of the High Sierra Nevada, California, F. V. Coville; Variation in Native Ferns, by W. M. Beauchamp; Live-forever Eradicated by a Fungous Disease, D. G. Fairchild: Otto Kuntze's Changes in Nomenclature of North American Grasses, G. Vasey; Revised Nomenclature of the Arborescent Flora of the United States, B. E. Fernow and G. B. Sudworth: On Carphoxera ptelearia, the New Herbarium Pest, C. V. Riley; The Insect Fauna of the Mississippi Bottoms, H. E. Weed; Characteristics and adaptations of Desert Vegetation, F. V. Coville; Shrinkage of Wood as Observed Under the Microscope, F. Roth; Peziza sclerotium, L. H. Pammel; Temperature and Some of Its Relations to Plant Life

L. H. Pammel; Pleospora of Tropaeolum majus, B. D. Halstead; Secondary Spores of Anthracnoses, B. D. Halstead; A Bacterium of Phaseolus, B. D. Halstead; The Significance of Cleistogamy, T. Meehan; The Animal Parasites of Dogs, E. W. Doran; A Preliminary Note on the Anatomy of the Urodele Brain as Exemplified by Desmognothus fusca, P. A. Fish.

SECTION H, *Anthropology.*—Thursday, Aug. 18.—River Pebbles Chipped by Modern Indians, as an Aid to the Study of the Trenton Gravel Implements, by H. C. Mercer; Canyon and Mesa-ruins in Utah, by Warren K. Moorehead; A Few Psychological Inquiries, by Laura Osborne Talbott; Some Indian Camping Sites Near Brookville, Indiana, by Amos W. Butler; On Some Prehistoric Objects From the White Water Valley, by Amos W. Butler; The Early Religion of the Iroquois, by W. M. Beauchamp; Early Indian Forts in New York, by W. M. Beauchamp; Ancient Earthworks in Ontario, by C. A. Hirschfelder; Evidences of Prehistoric Trade in Ontario, by C. A. Hirschfelder.

Friday, August 19.—Anvil-shaped Stones from Pennsylvania, D. G. Brinton; Vandalism Among the Antiquities of Yucatan and Central America, M. H. Saville; The Department of Ethnology of the World's Columbian Exposition, F. W. Putnam; Exhibition of a Large Model of the Serpent Mound of Adams County, Ohio, at 2 P. M., F. W. Putnam; Involuntary Movements, Jospeh Jastrow; Tusayan Legends of the Snake and Flute People, Matilda C. Stevenson; A Skull of a Pig Having a Flint Arrowhead Imbedded in the Bone, E. W. Claypole; Primitive Number System, Levi L. Conant.

Monday, August 22.—On Some Remains From the Oldest River Gravels Along the White Water River, Amos W. Butler; On the Earthworks near Anderson, Ind., Amos W. Butler; Comparative Chronology, by W. J. McGee; Brief Remarks Upon the Alphabet of Landa, Hilborn T. Cresson; The Peabody Museum Honduras Expedition, F. W. Putnam; Explorations on the Main Structure in Copan, Honduras, Marshall H. Saville; Aboriginal Quarries of Flakable Stone, and Their Bearing Upon the Question of Palæolithic Man, W. H. Holmes; Singular Copper Implements and Ornaments From the Hopewell Group, Ross County, Ohio, W. K. Moorehead; The Sacred Pipestone Quarry of Minnesota, and the Ancient Copper Mines of Lake Superior, W. H. Holmes.

Tuesday, Aug 23.—Proposed Classification and International Nomenclature of the Anthropological Sciences, D. G. Brinton; Pre-

historic Earthworks of Henry County Indiana, T. B. Redding; On the So-called Paleolitic Implements of the Upper Mississippi, W. H. Holmes; A Definition of Anthropology, Otis T. Mason; Pueblo Myth and Ceremonial Dances, F. H. Cushing; Demonstration of a Recently Discovered Cerebral Porta, Charles P. Hart; Ruins of Tiahuanaco, Mr. Douglass; Points Concerning Fort Ancient, Selden S. Scoville; Exhibition of a Suite of Prehistoric Pottery from a Mound on the Illinois River, between Peoria and Havana, J. Kost.

Saturday, August 20 was occupied by excursions. These were to Niagara Falls; to Canandaigua Lake; to the Portage Gorge of the Genessee River, which was of interest to geologists; and to Stony Brook Glen, another gorge south of Rochester, which was of interest to botanists. On Wednesday, August 24 an excursion went to the Fish Hatchery of the State at Mumford.

On the evening of Friday, the 19th, the ladies of Rochester gave a reception at the Powers Art Gallery.

Excursions to the Adironkack Mountains and the River St. Lawrence were projected to succeed the Hatchery excursion.

The next meeting will be held at Madison, Wis., beginning the third Thursday in August, 1893. The following is the list of officers for the ensuing year:

President, William Harkness, Washington, D. C. Vice-Presidents, A. Mathematics and Astronomy, C. L. Doolittle, South Bethlehem, Pa.; B. Physics, E. L. Nichols, Ithaca, N. Y.; C. Chemistry, Edward Hart, Easton, Pa.; D. Mechanical Science and Engineering, S. W. Robinson, Columbus, O.; E. Geology and Geography, Charles D. Walcott, Washington, D. C.; F. Zoology, Henry F. Osborn, N. Y.; G. Botany, Charles E. Bessey, Lincoln, Neb.; H. Anthropology, J. Owen Dorsey, Tacoma, Md.; I. Economic Science and Statistics, William H. Brewer, New Haven, Conn. Permanent Secretary, F. W. Putnam, Cambridge (office Salem), Mass. General Secretary, T. H. Norton, Cincinnati, O. Secretary of the Council, H. L. Fairchild, Rochester, N. Y. Secretaries of the Sections, A. Mathematics and Astronomy, Andrew W. Philips, New Haven, Conn.; B. Physics, W. LeConte Stephens, Troy, N. Y.; C. Chemistry, J. U. Nef, Chicago, Ill.; D. Mechanical Science and Engineering, D. S. Jacobus, Hoboken, N. Y.; E. Geology and Geography, Robert T. Hill, Austin, Tex.; F. Zoology, L. O. Howard, Washington, D. C.; G. Botany, F. V. Coville, Washington, D. C.; H. Anthropology, Warren K. Moorehead, Xenia, O.; I. Economic Science and Statistics, Nellie S. Kedzie, Manhattan, Kas. Treasurer, William Lilly, Mauch Chunk, Pa.

Entomological Club of the A. A. A. S.—Thursday, August 18.—E. A. Schwarz, President; Howard Evarts Weed, Secretary. The following papers were read: Preparatory Stages of Colothysanis amaturaria, D. S. Kellicott; Insects Reared From Galls on Muhlenbergia mexicana, F. M. Webster; Notes on the American Bean Weevil, C. V. Riley; Galeruca calmariensis Polygoneutic at Washington, C. V. Riley; Galeruca calmariensis Monogoneutic at New Brunswick, N. J., J. B. Smith; The Inhabitants of a fungus, H. G. Hubbard; Life-history of Zenos, H. G. Hubbard; A Cutaneous Disease of Cattle Caused by an Arachnid, C. W. Stiles.

Friday, August 19.—Life-history of a Fungus, H. G. Hubbard; The Males of Xyleborus, E. Schwarz; Notes on a Trip to Nepigon, James Fletcher; The Synonymy of the Bean Weevil, C. V. Riley; Notes on the Species of Acanthia, Herbert Osborn; Honey-bee or House-fly, Herbert Osborn; Life History of Gryllotalpa borealis, E. W. Doran; Notes on the Arthropoda of Liberia, O. F. Cook; The Osage Orange Pyralid, Mary E. Murtfeldt; Note on a Borer in the stem of the Red Current, E. W. Claypole.

Botanical Club of the A. A. A. S.—Thursday, August 18.—V. M. Spalding, President; D. G. Fairchild, Secretary. The following papers were read: Some Nomenclatorial Problems, N. L. Britton; The Use of the Terms Range, Locality, Station, and Habitat, F. V. Coville; Travels in Paraguay, and Its Flora, Thomas Morong; A Variety of Polypodium vulgare L., New to America, L. M. Underwood; Some of the Rare Mosses of White Top and Vicinity, recently Collected on a Trip to Southwestern Virginia (with specimens), Mrs. E. G. Britton; Symbiotic Growths in the Roots of Ranunculaceæ. (Presented by W. R. Dudley), T. B. Maxwell; Galvanotropism, J. C. Arthur; Anatomy as a Special Department of Botany, Emily L. Gregory; A Botanical Terminology, A. A. Crozier; Notes on Some Pear and Apple Diseases, M. B. Waite; Modifications of the Tomato Plant Resulting from Seed Selection, E. S. Goff; Some Rare and Interesting Fungi from Florida (with specimens), W. T. Swingle.

Friday, August 19.—Observations Upon Certain Species of Asclepiadaceæ as Insect Traps, Thomas Morong.

Monday, August 22.—General Notes on the Cryptogamic Flora of Liberia, O. F. Cook; Cultivated Species of Brassica, L. H. Bailey; Notes on the Distribution of Plants in Florida, P. H. Rolfs; North American Cacti, J. M. Coulter; On the Proposed Hand-book of Mosses of Eastern America (with illustrations), Mrs. E. G. Britton;

Weeds and Weed Roots, B. D. Halstead; The Re-discovery of Juncus cooperi, F. V. Coville; Some General Questions in the Classification of Myxomycetes, O. F. Cook; The North American Amelanchiers, N. L. Britton; Observations on the North American Species of Orchidaceæ and Their Nomenclature, Thomas Morong; A New Form of Root Cage, J. C. Arthur; On the Genus Campylopus in North America (with specimens), Mrs. E. G. Britton; Note on a Recent Outbreak of Peach Yellows near Ann Arbor, Michigan, A. A. Crozier; Some Observations on Epigæa repens W. P. Wilson.

Tuesday, August 23.—Notes on the Moutain Flora of Northern Alabama, Charles Mohr; The Botanical Garden Movement in New York, N. L. Britton; A Few Additions to the Hepatic Flora of the Manual Region, L. M. Underwood; Notes Upon a Revision of the North American Naidaceæ, Thomas Morong; Some Noteworthy Features of the Flora of West Virginia, C. F. Millspaugh; Notes on Some Species of Crataegus, N. L. Britton; Observations on the Ripening of the Seeds of Cuphea, Mrs. H. L. L. Wolcott; On the Genus Ditrichium in North America, with One Western Species and Corrections for Two Eastern Species (with specimens,) Mrs. E. G. Britton; Notes on Terminology, Theodore Holm; Notes on Some Fungi Common During the Season of 1892 at Ames, Iowa, L. H. Pammel; Notes on Some Kansas Weeds, A. S. Hitchcock; Notes on the Flora of Block Island, W. W. Bailey; Notes on the Distribution of a Few Plants, L. H. Pammel; Phaenological Notes for 1892, L. H. Pammel.

National Geographic Society of Washington, D. C.—The meetings are on Friday evenings, at 8.30. The following papers were read during the past season: Jan. 29, The Bryant Expeditions to Grand Falls, Labrador, Prof. C. A. Kenaston; Feb. 5, A New Track in Alaska, Dr. C. W. Hayes; Feb. 12, Iceland, Prof. Charles Sprague Smith; Feb. 19, The Temples and Pyramids of Egypt, Mr. Lysander Dickerman; Feb. 26, Military Surveying During the Civil War: Our Side, Mr. Gilbert Thomson, The Other Side, Maj. Jed. Hotchkiss; March 4, The Alaskan Boundary Survey, Dr. T. C. Mendenhall, Mr. J. E. McGrath, and Mr. J. H. Turner; March 11, The Seal Islands, Mr. J. Stanley-Brown; March 18, Coon Mountain, Arizona, and the Diablo Meteorites, Mr. G. K. Gilbert; March 25, The Evolution of Geography, Maj. J. W. Powell; April 1, The Cruise of the "Albatross" Through the Straits of Magellan, Prof. Leslie A. Lee; April 8, Russia, Hon. John W. Foster; April 15, The Cliff Dwellers, Mr. W. H. Holmes; Ocean Temperatures and Fish Migrations, Col. Marshall

McDonald; April 22, The Nicaragua Canal, Hon. Warner Miller or Civil Engineer A. G. Menocal, U. S. N.; April 29, Compensation of the Compass on Board Iron Ships, Lieut. S. W. B. Diehl, U. S. N.; Various Theories of Terrestrial Magnetism, Prof. Cleveland Abbe; May 6, Mesopotamia, Rev. Prof. John P. Peters; May 13, The Gates and Straits of Europe and Africa, Mr. Talcott Williams.

The Biological Society of Washington, D. C.—May 14.—The following communications were read: The Photogenic Organs of Fireflies, Prof. W. H. Seamen; A New Prairie Dog From Mexico, Dr. C. Hart Merriam; Where Salt-water Fishes Hide: Results of Deep-water Seining, Mr. Charles Hallock; Additions to the Flora of Washington, with exhibition of specimens, Mr. Theo. Holm; The Use of Certain Terms in Geographic Distribution, Mr. Frederick V. Coville.

May 28.—Communications: On the Superfamily *Chætodontoidea*, Dr. Theo. Gill; Coon Cave, Missouri, Dr. C. Hart Merriam.

June 11.—The Southern Fur Seal (*Arctocephalus*) at Guadalupe Island, Dr. C. Hart Merriam; Uses of Plants Among the Panamint Indians, Mr. Frederick V. Coville; On *Amarantus crassipes* Schlectendal, Mr. J. M. Holzinger; The Death Valley Expedition—lantern illustrations, Dr. C. Hart Merriam.

FREDERIC A. LUCAS, Sec.

SCIENTIFIC NEWS.

Dr. Carl Berg has been appointed Director of the Museo Publico of Bueno Aires as successor to the late Prof. Hermann Burmeister.

Recent Deaths.—Dr. Veit Graber, Prof. of Zoology at Czernowitz, well known for his work upon Hexapod Embryology, at Rome, March 3, 1892, on a journey to Naples, aged 48 years. Dr. Carl August Dohrn, the President of the Stettin Entomological Society and father of Dr. Anton Dohrn, May 4, 1892, aged 86 years. Riccardo Canestrini, at Padua December 22, 1891, aged 34 years; he was a student of the mites.